Croplife

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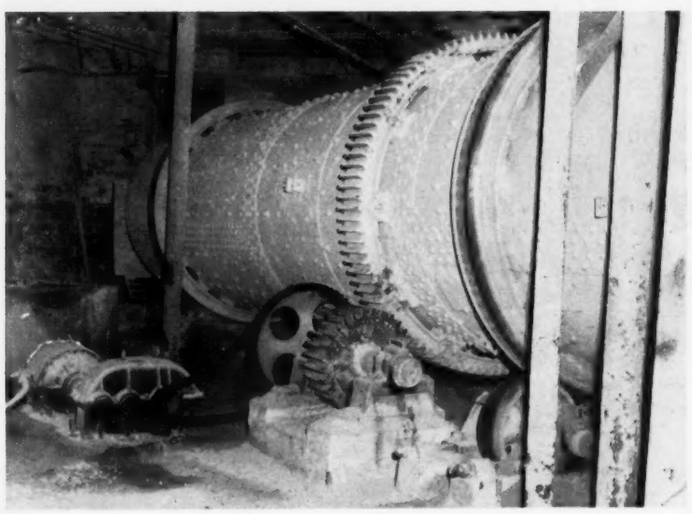
for Manufacturers of Chemicals for Agriculture



MEN AND MACHINES . . .

Problems of Production and Safe Practices in Fertilizer Granulation

By Elmer C. Perrine
Nitrogen Division, Allied Chemical Corp.
New York City

THE GRANULATION of fertilizers has added new problems of chemical processing to those of low cost handling of low cost materials; problems that have been with the fertilizer industry for a hundred years.

The economics of granulation encourages several chemical and several physical involvements that test the understanding of some of the men upon whose shoulders have fallen the responsibilities of production. More is being demanded of equipment than some of it can endure with any reserve of safety.

The industry has shown that it can curb many of the accidents that are associated with mechanical equipment being used and with men who must earn their bread by the sweat of their brow. The industry must also learn how to cope with the potentials that come with the new chemicals and their combining, as well as with the new mechanical equipment.

Caging the menaces of moving machinery is easily done, for their hazards can be seen by those who will look. These hazards proclaim themselves by their rotating or reciprocating or linear movements and with roaring, buzzing, or clattering noises as though they were pawing the earth for their next victim. They should be treated as rattlesnakes in the industrial fields, and made harmless by caging.

There is a lot of large rotating machinery in a granulating plant, driven usually by large ring gears and smaller pinion gears and sometimes through

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Inside You'll Find

Taylor Chemical Supplies Pesticides to Southeastern States 2
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Pesticide Manufacturer Maintains Modern Plant For Southeastern States

NOT every firm has the distinction of having survived a major blow just three months after starting business, but the Taylor Chemical Co., Aberdeen, N.C., not only survived the closing of its local bank just 90 days after the chemical firm was launched, but managed to increase its sales each year for the next two decades.

Jack M. Taylor, president of Taylor Chemical, looks back on the early struggles of the firm with a chuckle, and considers those days as being merely a necessary part of getting under way in business. Right now, he is too busy taking care of present-day affairs and planning for the future to spend much time reminiscing.

The company's pesticidal products serve a broad need of the agricultural economy of the southeast, with about half of its output being geared to the cotton crop. In 1933, when the firm began operations, 75% of its products was for fruit, Mr. Taylor says. Now the base is broader and business more stable.

The oldest product made by the Taylor firm is lime sulfur solution which has been made in Aberdeen by this plant and its predecessor for 38 years. "About eight years ago we figured that lime sulfur solution would soon come to an end due to the new organics. However, we find a renewed interest in it and last year our sales exceeded any other year in the business. We experienced our greatest growth just

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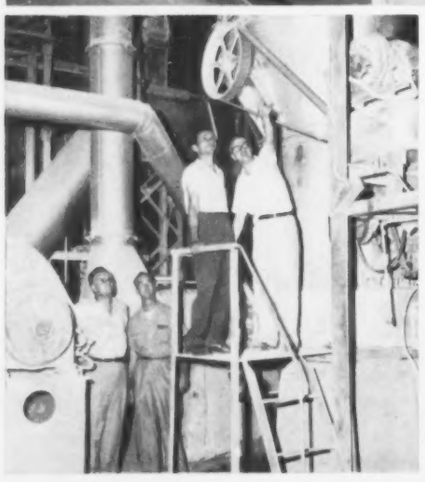
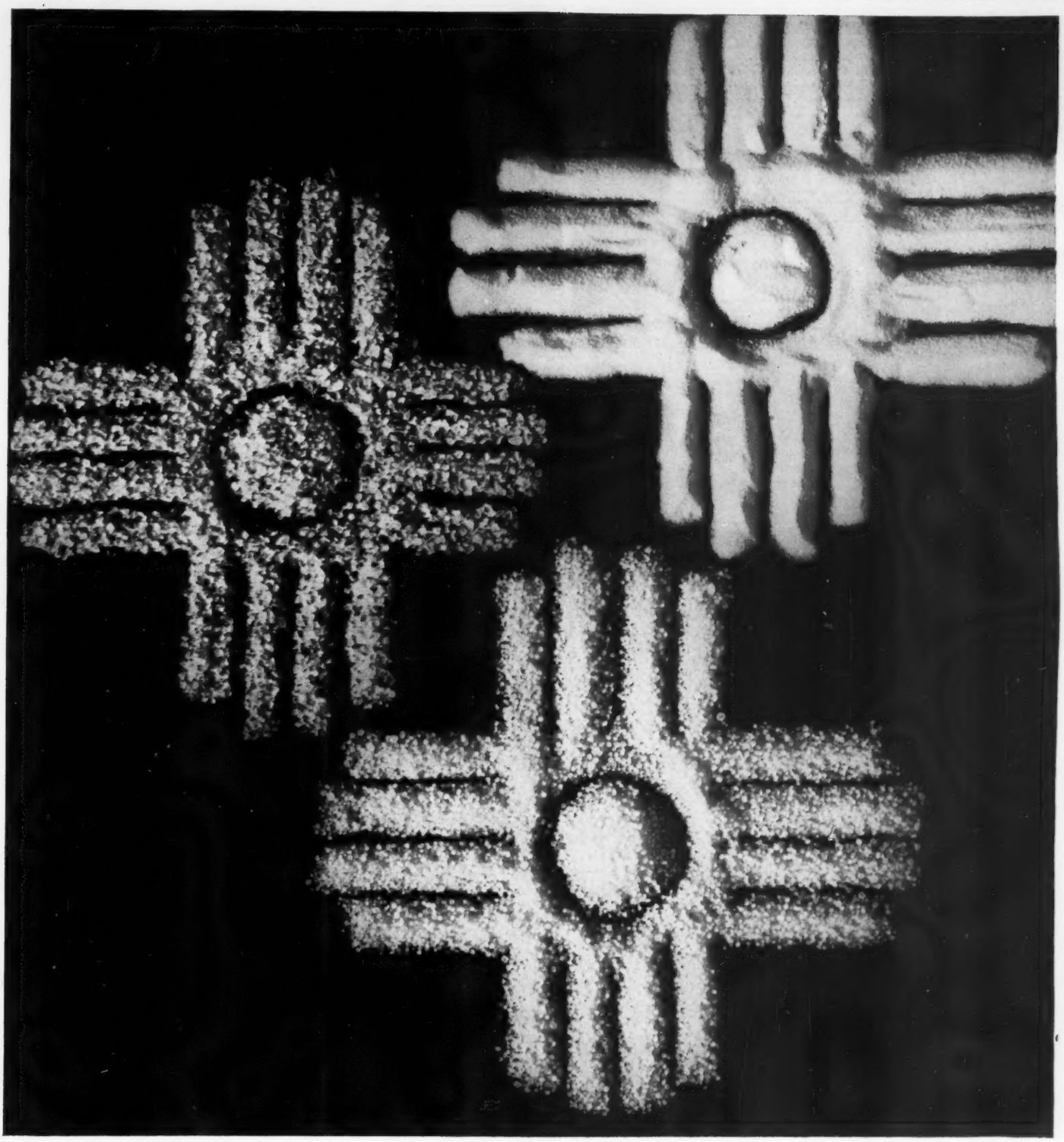
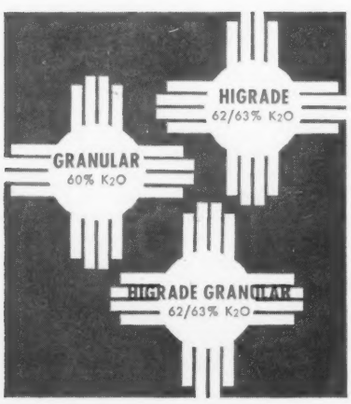


PESTICIDE PRODUCTION — Top photo shows wide-scale shot of Taylor plant with neat lawn as seen from highway. At left: J. M. Taylor, president, and George Anderson, vice president of company in office. Second photo: new laboratory facilities of Taylor Chemical for quality control of products. In photo, left to right, are Bob Morrell and Henry Medlin, chemists, and Jack Tribble, vice president in charge of production. Below, left, are Dan Farrell, vice president and sales manager, Jim Conner, entomologist, Mr. DeCosta, plant employee, and Mr. Morrell. Center are Mr. Tribble and J. O. McKeithen, foreman of the plant. Lower right: Messrs. Conner, Taylor and Farrell with the two company airplanes utilized to cover their marketing area thoroughly and quickly. (Photos courtesy Taylor Chemical Co.)



Better fertilizers begin with three top quality grades of USP potash



For the manufacture of all modern fertilizers, USP offers *three* outstanding grades of potash: two white grades—Higrade muriate and Higrade Granular muriate—each containing 62/63% K_2O, and each specially sized to meet current fertilizer manufacturing requirements. These white muriates give you the most potash per ton for mixed fertilizers. And USP's Granular muriate, containing 60% K_2O, is ideally suited for fertilizer uses requiring a still larger particle size. All three grades resist caking and remain free-flowing for easy storing and handling.

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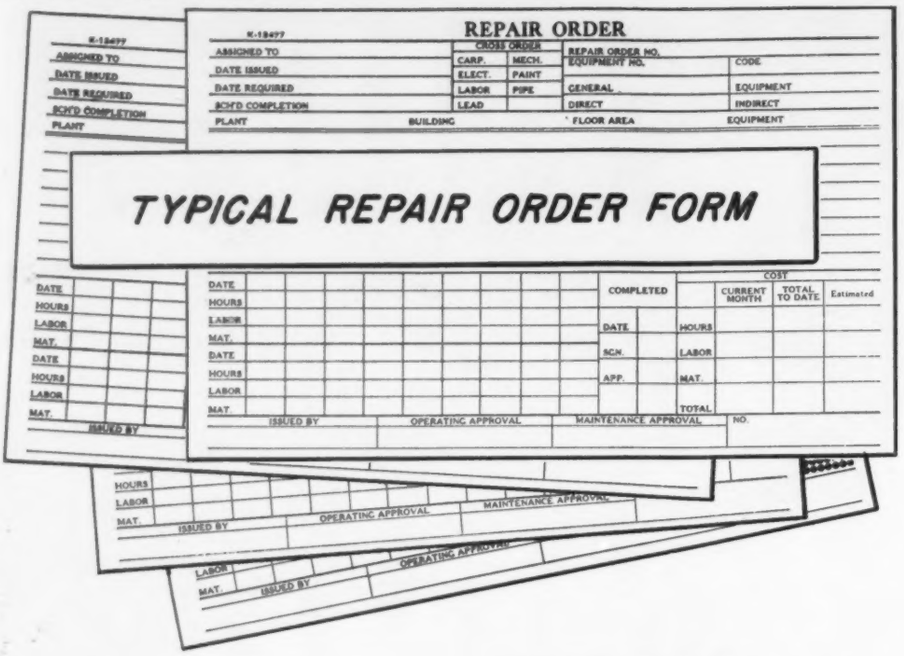

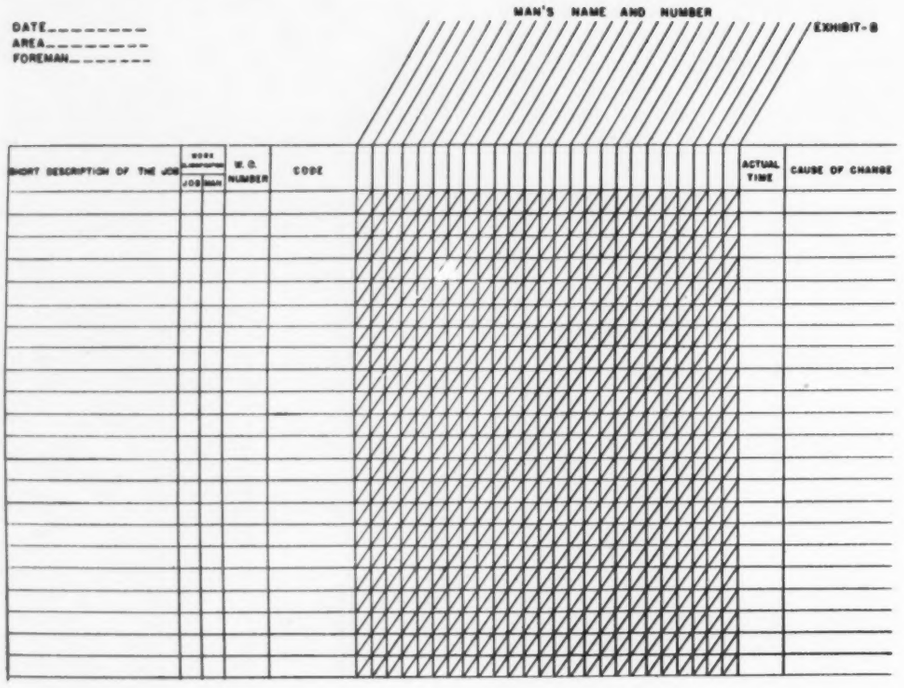

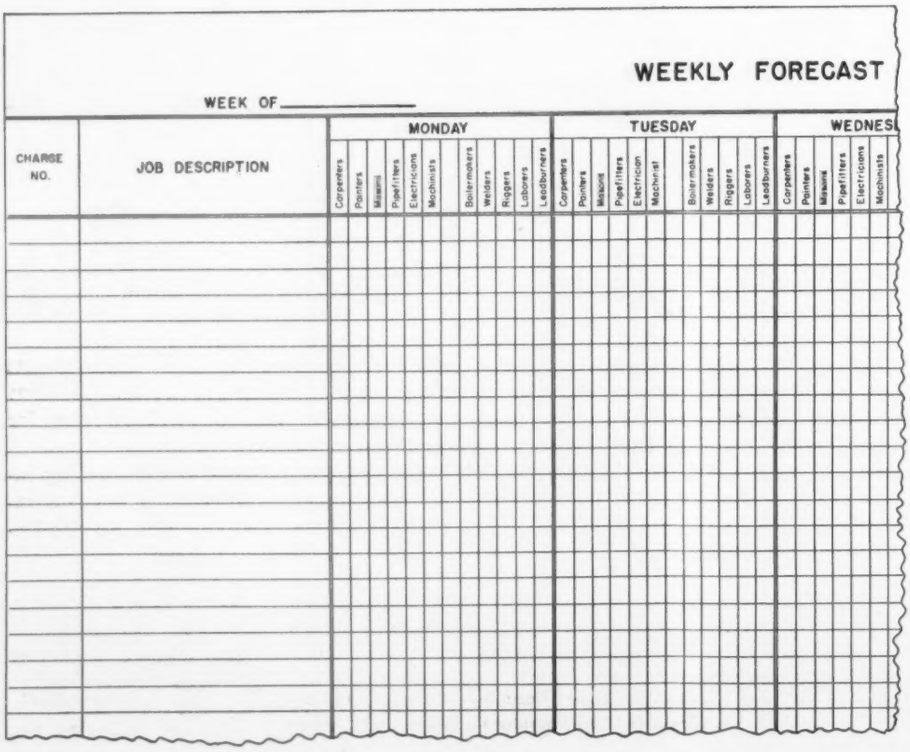

How to Control PLANT

By J. C. Jessen*
Engineering Service Division
Engineering Department
E. I. du Pont de Nemours & Co., Inc.
Wilmington, Del.

PROBLEMS of maintenance began somewhere in the dim past when prehistoric men began to sharpen up their primitive tools and weapons to prevent dullness and to assure maximum performance.

Maintenance problems are still with us, only now on a vastly greater scale with complex and interdependent plants and elaborate, expensive machines.

With the industrial revolution of 150 years ago came the "primary" tools to replace manual effort with machines like the cotton gin, steamboat, and locomotive. However, these tools made necessary the need for "secondary" or maintenance tools to keep the equipment operative.

In the years since, energy supplied by muscle and dexterous fingers and hands has been constantly reduced, but with the continually higher investment in tools, the total number of employees has similarly increased. This tends to nullify the apparent fears of some labor leaders that "automation is taking food from hungry mouths." The result of the greatly increased productivity is that more goods are available to more people at a lower cost.

What does all of this indicate? Technology is replacing manpower in production wherever possible by mechanical power and equipment. What we do not always appreciate is that the $33 billion worth of tools and equipment in this country begin to wear out the instant they are put into use.

Because of this complexity, the number of maintenance personnel in plants is on the increase. With batch-type plants, mechanics can maintain one pump or vessel without seriously disturbing over-all plant output. But when this equipment is tied together by conveyors or by piping systems, we have an integrated plant in which a whole system goes down when a single component fails.

Thus the need for adequate numbers of maintenance people is obvious, and with it also a definite plan of operation to keep the plant operating at its fullest capacity.

In larger companies, like du Pont with a tremendous diversity of plant size, plant age, products made, etc., it is difficult to establish any

*Adapted from paper presented at Fertilizer Industry Round Table, Washington, D.C., November, 1958.

MAINTENANCE AIDS—Keeping a close tab on maintenance within the plant demands special records and order forms to assign work and to have at hand records of repairs past, present and future. The forms at the left are self-explanatory, showing samples of record sheets and workmen's assignment blanks as well as a projection of maintenance work to be done in the future.

Costs in MAINTENANCE

one standard system of maintenance controls. What has been done, however, is the setting forth of a system of 18 basic maintenance tools to conform to each plant organization, accounting procedures, tabulating equipment, etc.

These rules, adaptable in almost any plant, are as follows:

1. Set up a proper maintenance organization.
2. Establish a work order system.
3. Keep equipment records.
4. Analyze and plan jobs.
5. Make weekly forecasts.
6. Prepare daily schedules.
7. Set up manpower backlog control.
8. Establish a preventive maintenance program.
9. Use budgetary control.
10. Provide material control.
11. Plan your plant shutdowns.
12. Set up major overhaul procedures.
13. Develop standard practices.
14. Use work measurement.
15. Improve your equipment.
16. Train your supervisors.
17. Train your maintenance men.
18. Analyze performance and costs.

These basic tools are listed in proper sequence of establishing on an existing plant that has been operating without a coordinated maintenance program. The system installed in a plant may vary considerably from the basic plan and may never use some factors such as "standard practices" or "work measurement."

Some of the du Pont plants that have introduced better maintenance procedures and controls have cut their maintenance costs as much as 20%. In many plants the effectiveness of maintenance labor has improved from the range of 40-45% to that of 70-75%. In some, even better results have been obtained. And in reduction of equipment downtime and increased productivity, all these plants have realized savings that alone have justified the cost. Of this we are sure:

Every one of these 18 basic tools can help trim costs and boost output.

Here is a point which should be emphasized. We don't aim merely to CUT production costs. Almost anyone can do just that and get away with it for awhile. But eventually, the accumulation of deferred maintenance will catch up with him.

The main purpose is to cut the manufacturing cost of the product and still maintain quality. Also, we're careful not to sacrifice employee safety. We've seen cases where zeal to attain low maintenance costs has ignored these important points, and wiped out expected savings.

Another point: Experience teaches that the best maintenance controls are of little value unless correctly used by maintenance supervisors. Also, higher management must give these controls its wholehearted support. There is no substitute for good management and good foremanship.

Now let's look at some of the 18 basic administrative tools for developing a successful maintenance program.

1. Set Up a Proper Maintenance Organization

Usually du Pont plants have more than one product, so that they naturally fall into a number of production areas, each of which is under the supervision of an area production supervisor. These areas may be more or less widespread and may have varied maintenance problems. A maintenance supervisor is assigned to each area and is responsible for all of its maintenance. He is a member of the maintenance organization but works very closely with the production supervisor of that area to coordinate maintenance with equipment availability and production schedules.

The maintenance employees assigned to the area are those required for routine maintenance and may have skills including rigging, millwright and pipefitting. In addition to the area mechanics, there are also mechanics of various skills in the "central skill" organization. The men in this or-

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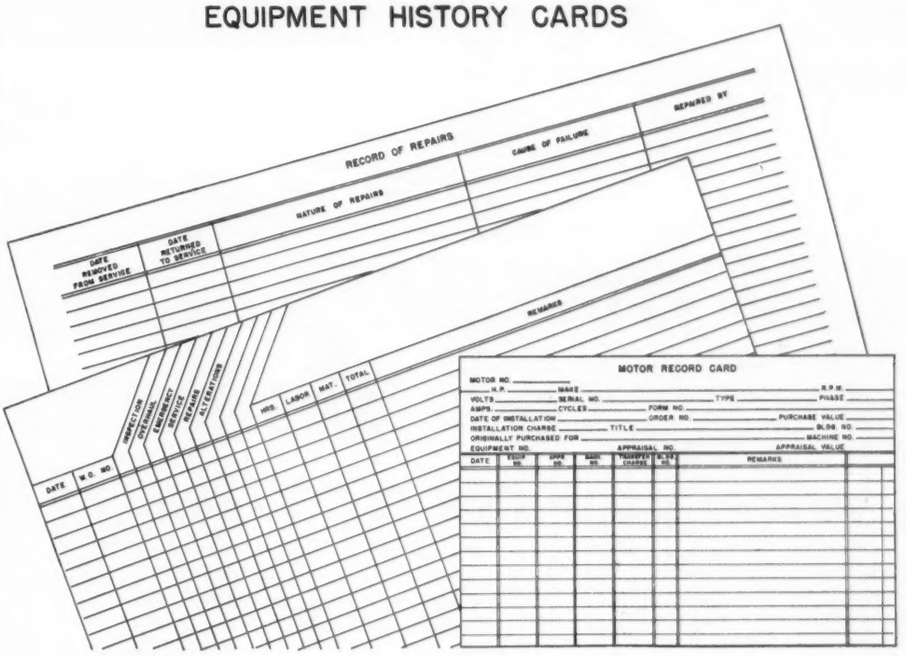
MACHINE HISTORY—Here's an effective way to keep a record on various machines and other equipment. The date it was installed, its original worth, its record of repairs, and remarks covering any peculiarities of the equipment are all included in the record. At the right is Mr. Jessen's plea for improved education for maintenance men. Experience shows good training pays off.

EQUIPMENT HISTORY CARDS



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- DEVELOPMENT OF "SKILLED MECHANICS" INSTEAD OF "CRAFTSMEN"
- SUPERVISORY DEVELOPMENT TO TEACH KNOWLEDGE OF PLANNING AND RUNNING A BUSINESS
- CONDITIONING OF MANAGEMENT TO UNDERSTAND MAINTENANCE PROBLEMS

PESTICIDE PLANT

Continued from page 2

after World War II when chlorinated hydrocarbons came into the picture and gave good results against boll weevils on cotton," Mr. Taylor continued.

The pesticide company classifies itself as a regional formulator with its principal operations comprising grinding and mixing, although it does manufacture a few products such as lime sulfur solutions as mentioned previously. "We cover the entire southeastern portion of the United States except the state of Florida," Mr. Taylor explains.

Since the firm's business is not local, but spread over the broad area of several states, two private airplanes are kept in operation for sales trips and personnel transportation. The first craft was purchased in 1944 and two years later a second one was bought. The two planes are familiar figures in the skies of the Carolinas, Virginia, Tennessee, Georgia and Alabama where the Taylor company does business. The planes make possible better coverage of the area with a minimum personnel and also add to the firm's service of which it is proud. As a matter of fact, the company's reputation is "founded and built on service," as indicated not only in its literature, but also by its actions. "We have always taken pride in serving the same customers year after year, and we believe our customer turnover is less than any other company in the industry," Mr. Taylor observes.

As is true in any business life, the road is not without bumps and steep grades. Although the firm's management was able to weather the storm precipitated by the deep depression of the 30's and the closing of the local bank (it never did open again), a fire in May, 1936, consumed the entire office and plant leaving the company temporarily without a base of operation.

A tribute to the pesticide industry is noted, however, in the fact that friends in the trade provided Taylor with an inventory of material so it was possible to relocate temporarily in a local warehouse and continue to serve customers in the busy early summer season. The plant relocated at its present site at the edge of Aberdeen, N.C. and has been expanding its operations there ever since.

With Jack Taylor in the operation of his firm are George Anderson, vice president; Jack Tribble, vice president in charge of production; Dan Farrell, who with Mr. Taylor purchased their original plant from Woolfolk Chemical Works in 1933; Jim Conner, entomologist, and Bob Morrell and Henry Medlin, chemists in the firm's laboratory.

Fire Threat Always Present in Plants, Fire Chief Reminds

There are several factors to be considered in evaluating the hazards that may arise in connection with fertilizer production, according to Charles W. Bahme, deputy chief of the Los Angeles fire department. In a recent talk, Mr. Bahme pointed out that fertilizer hazards may be grouped into two categories: the hazards arising before the fire, and those which may arise during a fire involving such materials.

Hazards before the fire arise principally from four or five conditions. The first of these concerns the storage of various chemicals, such as the oxidizing materials (sodium nitrate, ammonium nitrate, calcium nitrate) and their proper segregation from combustible inorganic materials such as sulfur, and organic materials (cotton seed meal, blood meal, etc.). Storage considerations also include the type of building, its location, and fire protection afforded.

Insofar as inherent hazards in the chemicals themselves, it is believed that there are none which cannot be adequately safe-guarded through the provision of proper containers, labels, segregation, and supervision. Ammonium gas, for example, while toxic, and to a certain degree flammable, offers no difficulties from a fire protection standpoint where proper safeguards have been provided.

Precautions against dust explosions are necessary in areas where clouds of organic dust may be dispersed in the air or accumulate on rafters, beams, etc. Good housekeeping can be the answer.

Blasting of caked mixed fertilizers has presented some hazard in connection with the storage and use of high explosives; the more common practice of using picks and jack hammers has largely eliminated this problem. Spontaneous heating in piles of compost and other organic additives can be controlled to a large extent by maintenance of moisture content and good ventilation. Insofar as inorganic mixtures are concerned, such as the super phosphates, a proper balance between the ammonia and sulfuric acid may prevent localized heating and subsequent fire.

With respect to fires in fertilizer plants, firemen have learned a great many lessons. The industry's frequent use of large, unsubdivided, wooden buildings, usually unsprinklered and often inadequately ventilated, has resulted in a small fire oftentimes consuming the entire plant.

"We have found wetting agents to be very helpful in fighting smouldering fires in bins of mixed fertilizers," Mr. Bahme reported. "Fires involving nitrates present the hazard of steam explosions when water hits any molten pools and the toxic fumes given off by its decomposition. Through the use of large volumes of water and self-contained breathing apparatus, we have been better able to cope with fires involving large quantities of ammonium nitrate, sodium nitrate, and similar oxidizing materials in warehouses and boxcars." Lessons have also been learned in fighting fires in such materials in holds of ships where improper fire fighting technique may result in serious losses.

Likewise in fires involving ammonia, firemen have learned that with the use of breathing apparatus and large quantities of water with which to dissolve the gas, serious consequences can be averted.

In summary, with the employment of reasonable precautions and a minimum of regulations, the municipal fire service has been able to achieve a fairly good standard of fire safety and has been rather successful in eliminating hazards before a fire occurs.

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GRANULATION PROBLEMS

Continued from page 1

intermediate jack shafts or chains and sprockets. Almost equally hazardous are the two pairs of tires and trunions upon which mixers, dryers and coolers rotate.

The age-old ring gear menace of rotary mixers should have conditioned the industry to handle this danger but there are many such potential grinders still left uncaged. Heavy hammers on mixers and dryers are not restrained in their ability to wreak havoc when they fall off. Some of them are hazards even in their normal round of duty.

Even slight variations from normal operations in granulation sometimes cause fouling of equipment. The admonition against it is rudimentary but men are still being injured by servicing equipment while it is running without adequate safeguards. Cases in point are mixers, rotary dryers and sometimes, even yet, the hammer mills.

Somewhere, even as you read this, a man without safety equipment is likely hammering on a flow meter in the belief that this will make it work to his liking, even though an important part of that meter is a large unprotected glass tube delivering under pressure considerable quantities of sulfuric acid, steam, nitrogen solutions or anhydrous ammonia.

The burners for dryers that have been installed by the equipment manufacturers, or with the approval of supplier of the fuel, are performing with good safety. They usually have interlocks that prevent making an oil or gas-fired seige gun or flame thrower of the dryer; a precaution that is not always present in do-it-yourself kits.

Silent, unobtrusive dangers may exist through omission, or through economy in installation, or through the inherent nature of some equipment and its arrangement or even in the ingredients of a process.

To avoid costly shutdowns, or worse, it becomes necessary at times for men to get to some critical point in the process very quickly in granulation plants. This suggests adequate stairways, catwalks, grids over pits, ventilation, lighting, water and other first aids. Some arrangements are such that escape hatches would seem to be necessary, as it would be only through them that personnel could escape in some installations. In the typical granulation plant no man should work entirely alone, for very long at a time.

The understandable desire to hold the crew to a minimum can extend so far that the safety factor stemming from numbers is lost. There has been a great increase in electrical equipment, much of it overloaded and far too few lock-out switches to protect maintenance men while they are servicing the equipment.

Materials and equipment that were adequate for their original use have been misapplied without consulting the suppliers. The rubber or synthetic diaphragms and hoses that have served so long in nitrogen solution services are not suitable for sulfuric acid but there are materials such as teflon diaphragms that are suitable. Anhydrous ammonia has been handled through low pressure diaphragm valves, a very dangerous practice. Where plastic pipe and hoses are installed and used as recommended by the makers, good service is obtained. Some operators fail to check the suitability of plastic fittings for a service. Such checking should be done because fittings are sometimes made from materials differing from the hose. (Note carefully that some plastic hose and pipe lose physical strength rapidly at the higher temperature to which they are subjected. Failure to use adequate bands or bands of suitable materials to resist corrosion has caused failure of plastic hose at the joints.)

Pumps are being used in increasing numbers in granulation plants and on the wisdom of their choice, operations, and maintenance depends the safety of many men and even the ability to operate some plants at all in some cases. A correctly specified centrifugal pump will deliver the desired volume at the required pressure and will generate very little more pressure, often somewhat less, when the discharge line is closed. This is a built-in safety feature but only when the pumps have been correctly chosen.

One installation used a pump of such large capacity that it delivered pressure at the meter that proved to be excessive when the flow was at a low operating level. The nitrogen solution hose was forced from its connection where a man was adjusting the flow valve and he was placed in real peril, being fortunate to escape with only painful injuries. The sulfuric acid system was similarly arranged. Here is a distinct menace from providing equipment that is too large, a rare occurrence in the fertilizer industry. Positive displacement pumps such as gear and piston types must have provisions for excess pressure relief for safe operations.

The materials used in equipment and the nature of some of the ingredients as well as the process itself may carry some risk. Accurate meters may deliver the proportions of chemicals that have been calculated to yield the desired analysis in a ton of fertilizer and do this safely, and there may be rather clear cut dangers if these proportions are exceeded very much.

Safety in proportioning is complete only if every region of the mass is protected against these dangerous excesses. This calls for a uniform distribution of the chemically-active ingredients throughout the mass with safeguards against local build-ups. Original design is not enough. Through correct choice of materials of construction this design must persist and, failing this, frequent inspection by persons who understand the needs should be instituted. Replacements should be made as early as needed. What is the gain if great care is exercised to proportion the ingre-

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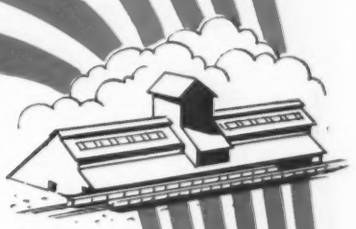

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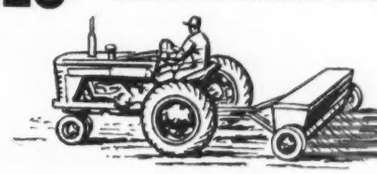

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dients of the ton if the final proportioning in the mixer ignores the distribution of the pounds?

A case has recently come to light which emphasizes the necessity for complete measures for safety in the granulation of fertilizer. The formula justified the 150 lb. 66° Be sulfuric acid specified for the continuous process through a flowrator.

After a day of excessive plasticity, heats, and conditions that presage fires in the mixer, an inventory check revealed that an average of some 50 lb. excess of acid had been delivered per ton of fertilizer. Quite probably the overage was higher by the time the situation had become serious.

The float of the flowrator showed considerable corrosion which reduced its weight and allowed more acid to flow around it than was being indicated. That portion of the float which largely determines the accuracy of the meter and is very precisely machined to a tolerance of four ten-thousands of an inch had been reduced by some 50 thousands of an inch in diameter. The metal of this float was number 316 stainless steel which is generally used with satisfaction for 60 and 66° Be sulfuric acid.

It developed that the sulfuric acid system was being flushed out with water after each use, particularly before shut-downs of any duration, as a safety precaution, and a good precaution this is, for many operations.

The flushing water was passed into the mixer and since much water there becomes a problem, it is quite likely that not enough water was being used to completely remove all acid. Diluted sulfuric acid has the peculiar property of attacking some metals, 316 among them, that are suitably resistant to the higher concentrations.

Either thorough flushing with water or the substitution of more suitable metals such as Hastaloy are recommended for such cases. The alternates of leaving the system filled with concentrated acid or attempting to completely drain the system without flushing have their hazards.

Many granulating formulae have lost the moderating influence of several hundred pounds of inert filler. Increasingly granulation is being done in mixers and dryers with a liquid phase achieved by increasing the heat through chemical action, with water at so low a level as to lose much of the protection of water that existed in earlier operations. This underscores the need for uniform distribution of all ingredients and actions. Acids, nitrogen solutions and superphosphates are now often much "dryer" than formerly.

To obtain more tons of product at low enough moisture level for good storage, some products become so hot in the dryer that noxious fumes are produced in quantities too great for the dryer fan and these fumes are often channeled to the stations of some workers. More cooling may be as effective for conditions as excessive drying, is much safer and more economical. Failure of the process at critical times, or ill-advised adjustments by the operator, invite many hazards needlessly.

Irregular recycling of fines is a source of concern as much for safety as for production. Conditions develop where the operator feels forced to "do something even if it is wrong." Time-lags in the process stack the cards against quick changes. Most operators have learned that adding more sulfuric acid will increase the heat of the mass and eliminate ammonia fumes. Technical persons have calculated this balance and the equipment has been designed to implement this formula. Technical persons also know the limits of these balances and quite probably the normal operations are near the limits for safety.

As the industry approaches the limits of safety in processes, materials, and formulation the failure of any man, or piece of equipment, in the line can have greater and greater consequences.

The experienced formulator as well as the electric computer can indicate the point at which, theoretically, the addition of sulfuric acid for ease of granulation with economy and safety should cease. With all the care of computation and on-the-job instruments the plant still needs experienced operators who can forestall trouble by constant watchfulness. There are processes where nitrogen solutions and acids are mixed directly, but that is a distinct process very carefully controlled. Only these two ingredients are involved at the time of their mixing, there being no dependence of any diluent other than easily controlled water that may fail to arrive and there is no additional chemical which can add dangerously to an already intense action. In many normal granulation systems these two features can and do develop failure of the supply of desirable diluents and presence of complicating chemicals.

The moderating diluents, such as normal ingredients as well as recycle, and even perhaps of added water may not at times be present in required amounts in either the continuous or the batch mixers. The action of sulfuric acid on potassium chloride may lead to fires or even explosion in the mixer in extreme cases of failure of equipment or of men.

It may be unfortunate that it is so easy to substitute in existing equipment the use of so much acid to obtain more tons of granulation. Were there to be no dissipation of heat from the mass in a mixer through radiation, evaporation of water, cooled recycle, flow of air or any other factor, the heat of reaction of only 100 lb. of 66° Be sulfuric acid with ammonia would raise the temperature of a ton of fertilizer to a very high level. In practice, fortunately, the total heat loss is enough to make practically all granulation relatively safe so long as all of the restraining factors are in reasonable force.

Early granulation processes used, and some still use, as much as 9% and even 12% total water to achieve results. The evaporation of one pound of water uses enough heat to cool a ton of fertilizer about 2° F. and there was a considerable amount of control over heats as indicated by the fact that few of these processes reached 220° F. measured in the mixer.

Part II of Mr. Perrine's article will appear in the next Production Edition.

HEPTACHLOR SOIL INSECT SELLING THEME for 1959!

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CROPS: corn, potatoes, vegetables, other crops
TIMING: March, April, May

KENTUCKY
INSECTS: wireworms, mole crickets, seed corn maggots, tobacco webworms, green June beetles, cutworms
CROP: tobacco
TIMING: April & May

EASTERN STATES
INSECTS: wireworms, white grubs, European Chafers, rootworms, Colorado potato beetles, flea beetles
CROP: potatoes
TIMING: January through April

SOUTH CENTRAL STATES
INSECTS: Rough headed corn stalk beetle
CROP: corn
TIMING: March & April

GEORGIA-ALABAMA
INSECTS: wireworms, southern corn rootworms, white fringed beetle larvae, Colorado potato beetles
CROP: potatoes
TIMING: January and February

INSECTS: white grubs
CROP: peanuts
TIMING: March and April

THE CAROLINAS
INSECTS: thrips, southern corn rootworms
CROP: peanuts
TIMING: April, May

INSECTS: wireworms, cutworms, flea beetle larvae
CROP: tobacco
TIMING: March

INSECTS: wireworms, southern corn rootworms, white grubs
CROP: corn
TIMING: February

FLORIDA
INSECTS: wireworms, cutworms, white grubs, white fringed beetles, mole crickets, rootworms, flea beetles, ants
CROPS: sweet corn, tomatoes, potatoes, melons, vegetables, other crops
TIMING: September through December

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Arcadian® News

Volume 3 | For Manufacturers of Mixed Fertilizers | Number 12

Making 16-8-8 with all the nitrogen from SOLUTIONS

The **16-8-8** granular fertilizer, illustrated above, was produced by a new and different technique of progressive ammoniation, with *all* the nitrogen in the fertilizer derived from ARCADIAN® Nitrogen Solutions.

Perfected by Nitrogen Division technical men, this new process involves the use of sulfuric acid with certain specified Nitrogen Solutions and no other nitrogen carrier.

Because all the nitrogen is obtained from Solutions, the cost of nitrogen is greatly reduced and there is room in the high-analysis mixture for normal superphosphate and other desirable ingredients.

Operation of the process requires certain modifications in standard ammoniating equipment, however the extra equipment cost is an excellent investment in view of the many advantages obtained. The re-cycle rate is low and permits full utilization of equipment with maximum output.

By this new method of ammoniation, air pollution is minimized and there is almost no loss of plant food. The 16-8-8, illustrated above, was formulated at 16.16-8.08-8.08. The end result of the process is a homogeneous product easily dried to 0.3% to 0.5% water. The extremely low moisture content helps the fertilizer to hold its quality over a long period.

This method is a major advance in the technique of manufacturing better fertilizers at lower cost. It will pay you to get all the facts on its simple operation and its many advantages. Contact: Nitrogen Division, Allied Chemical, 40 Rector Street, New York 6, N. Y.

For BIGGER Profits Put More N in N-P-K

It Pays to Make and Sell High-Nitrogen Fertilizers

Fertilizer manufacturers are faced with a golden opportunity to increase profits and expand markets by putting more nitrogen in mixed fertilizers.

Most of the leading fertilizer-consuming crops need more nitrogen than any other plant food. Corn, wheat and cotton require more than twice as much nitrogen as phosphoric acid, and far more nitrogen than potash. Many other crops are big users of nitrogen.

Yet the average mixed fertilizer contains less nitrogen than phosphoric acid and potash. To get the yields they want, farmers make up the difference with extra applications of straight nitrogen materials.

Trend to Straight Nitrogen

More nitrogen is sold as straight materials than in mixed fertilizers, and the use of nitrogen as straight materials is gaining faster than the use of nitrogen in mixed fertilizers.

Of course, it is not practical to supply all the nitrogen needs of some crops on some soils with mixed fertilizers. But, for most crops on most soils, it is practical, efficient, economical and profitable to supply more nitrogen in mixed fertilizers.

New Production Techniques

Today you are in a better position than ever before to take full advantage of this situation. The development of new ammoniation techniques enables you to greatly increase the nitrogen content of mixed fertilizers, with all the nitrogen derived from low-cost ARCADIAN® Nitrogen Solutions. Production of high-analysis, high-nitrogen mixed fertilizers is easier than ever before.

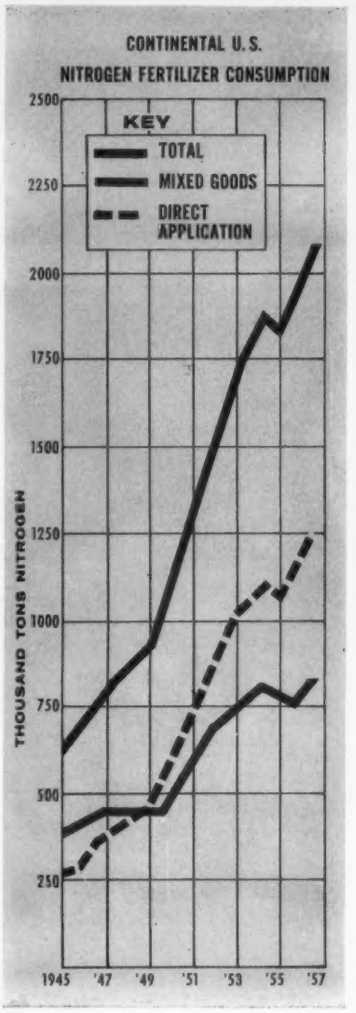
Bigger Dollar Volume

When you balance your fertilizer with adequate nitrogen to meet crop requirements, you also help to insure the best possible return from the phosphorus and potash in your fertilizer. Research has proved that sufficient available nitrogen increases a plant's efficient use of phosphorus and potash.

By producing high-analysis, high-nitrogen mixed fertilizers, you can put a bigger dollar volume of tonnage through your plant. You can also save money in storage and shipping costs per unit of plant food. These costs are becoming more important, with increasing freight rates and the necessity to warehouse more tonnage in late seasons.

Helps Your Dealer

With high-nitrogen fertilizers, you increase the farmer's profit, your profit and your dealer's profit. Your dealer can make better use of his storage and trucking facilities. He has less storage cost per dollar of inventory and he hauls a higher value pay load. Most important of all, he can supply his farmer customer with his complete plant food requirements in a one-sale, one-package deal. This builds exclusive customers and minimizes the danger of losing business to a competitor.



PLANT FOOD USE COMPARED TO CROP NEEDS

Crop	Acreage Fertilized	Average Pounds Used Per Acre*			Pounds Needed Per Acre For Good Yield			
		N	P	K	N	P	K	
Corn	60%	27	28	25	160	60	120	100 bu.
Cotton	58%	49	31	25	105	45	65	750 lbs.
Wheat	28%	18	27	19	70	30	50	40 bu.
Oats	30%	17	28	20	75	35	95	80 bu.

*On acres receiving fertilizer.

Ask Nitrogen Division

It will pay you to start now to make and sell more high-nitrogen mixed fertilizers. Get all the facts on the new and different production techniques that enable you to produce high-nitrogen mixed fertilizers with all the nitrogen derived from low-cost ARCADIAN Nitrogen Solutions. Contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

Cold Weather Handling of Nitrogen Solutions

Nitrogen Solutions with a high content of ammonium nitrate or urea salts are an economical source of nitrogen for production of high-nitrogen mixed fertilizers. But, certain precautions are required in handling these Solutions during cold weather, due to their tendency to "salt out."

Because of the high level of dissolved salts in these Solutions, their "salting-out" temperature is higher than that of Solutions containing more free ammonia or water. It is also higher than atmospheric temperatures during winter months in some areas.

The "salting-out" temperatures for all ARCADIAN® Nitrogen Solutions are shown in the specification chart on the following page.

These are the Solutions' temperatures at which crystals begin to form. Crystallization of nitrogen salts does not start until the temperature of the Solution actually reaches the "salting-out" or "saturation" point.

Accurate Laboratory Tests

The exact "salting-out" point of each Solution is determined in the Nitrogen Division laboratory by gradually cooling the Solution until crystals start to form. "Salted-out" samples are then warmed and dissolution points of crystals are checked against previously-determined "salting-out" temperatures, to avoid any possibility of inaccuracy due to super cooling.

Nitrogen Division technicians chill the Solution until crystals occupy much of the visible Solution space. The Solution is then warmed and its temperature at the disappearance of the last crystal is determined. The test is then repeated with very slow warming as the indicated dissolution temperature is approached.

When the "salting-out" temperature is obtained by this method, there is no possibility of salt deposition above this temperature. Slightly below this temperature, only incipient crystal formation is possible. Crystallization increases progressively as the temperature is lowered further and only at much lower temperatures will the Solution freeze solid.

Temperatures Change Slowly

Solution temperatures actually respond very slowly to changes in atmospheric temperature. Tank-car quantities of Solution must be exposed to low atmospheric temperatures for considerable periods of time before the Solution temperature will drop to atmospheric temperature.

The amount of solids that crystallize are in proportion to the temperature drop below the saturation point, and crystals dropping out of solution lower the "salting-out" point of the remaining liquid.

Openings in spray pipes and lines in the fertilizer plant are usually of sufficient size to enable Solutions carrying small amounts of crystals to flow without difficulty.

The table below shows the amount of salt which will separate from two NITRANA® Solutions at various temperatures below the "salting-out" point.

In practice, Solutions are often successfully handled and tank cars are completely unloaded, when atmospheric temperatures are considerably below "salting-out" temperatures. In such cases, it is important to avoid allowing Solutions to remain stagnant in pipe lines and equipment for a prolonged period. If there is to be a delay in operation, the system should be purged immediately.

APPROXIMATE POUNDS OF SOLID SALT FROM 100 POUNDS SOLUTION WHEN COOLED BELOW THE SOLUTION "SALTING-OUT" TEMPERATURE

SOLUTION	SALTING OUT TEMPERATURE	DEGREES BELOW "SALTING-OUT" POINT 5°F	10°F	15°F	20°F
NITRANA 4	56°F	2 lbs.	6 lbs.	8 lbs.	10 lbs.
NITRANA 4M	61°F	2 lbs.	5 lbs.	7 lbs.	9 lbs.

Ten Helpful Suggestions

The following suggestions will assist you in more efficient handling of NITRANA®, URANA®, and U-A-S® Solutions during cold weather:

1. Use shortest feed lines practicable. Eliminate unnecessary bends and constrictions. Install enough union-connections for convenient dismantling of lines for cleaning. Install tees or crosses instead of ells at bends to permit cleaning with rods or stiff wires. The branches of tees should be upward. There should be no sags or dips in the line.

2. Use only diaphragm-type valves.

3. When supply pipes are cold, do not introduce solution until mixing machinery has been started and the first charge of superphosphate is actually in the mixer. Then try to keep solution moving with a minimum of delay between charges. If for any reason delay is anticipated, blow the solution out of the measuring tank and out of pipe lines. Equipment should be arranged for blowing the solution back into the tank car or the storage tank.

4. When atmospheric temperatures are expected to be below "salting-out" point, do not transfer solution to storage tanks but use directly from tank car. Ammoniating Solutions are loaded hot and Nitrogen Division tank cars are well insulated.

5. Unless necessary, do not vent air from tank car until unloading is completed, since this is a cooling action.

6. After mixing operations have stopped and lines are cleared of solution, disconnect feed lines at tank car. This will avoid the filling of the piping through any leak in the shut-off valve.

7. Equip solution lines with water connection for cleaning. If warm water is available, use this for cleaning and also to warm up feed lines and tank car valves before introducing solution. Completely plugged lines should be opened sufficiently by rodding to permit some water to be forced through in order to speed solution of the salt.

8. It is advisable to have gauge glasses and connections of at least ¾-inch size.

9. Keep gauge glasses and gauge glass connections warm with electric heating devices or with electric lights. Infra lamps prove quite effective.

10. Insulate pipe lines wherever practical. Use the best insulation obtainable—but even dry burlap is better than no insulation.

HERE'S THE BIG LINE OF Arcadian® NITROGEN SOLUTIONS

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6	42.0	19.5	66.3	6.0	8.2	9.3	1.178	10	34
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

Other ARCADIAN® Products: N-dure® • UREA 45 • A-N-L® Nitrogen Fertilizer Ammonium Nitrate • American Nitrate of Soda • Sulphate of Ammonia

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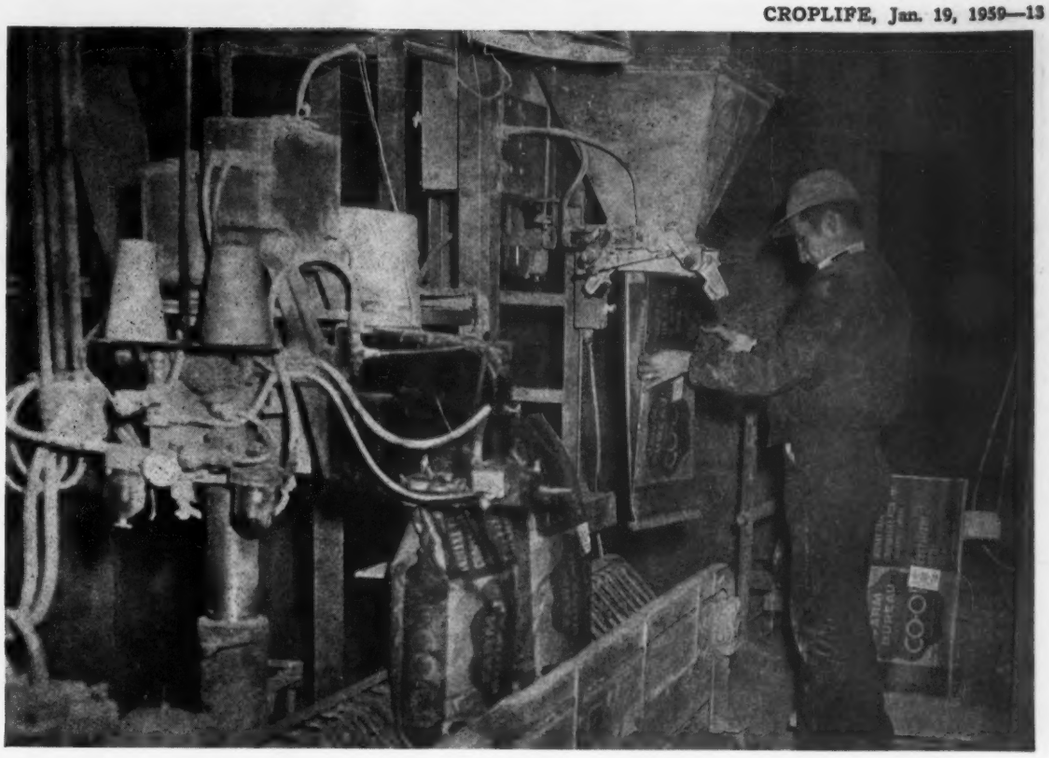

Losses from Overweights

By Donald W. Walczak
Bemis Bro. Bag Co.
Packaging Service

MANUFACTURERS of plant food materials and pesticides destined for use on the farm have a big stake in holding down possible losses through overweight bags, as well as being sure the contents of the container are up to label designation. In the first place, the combination of valuable materials with a too-low margin of profit makes the prospect of giving away hundreds of pounds of finished products at variance with good business practices.

The other side of the coin leaves little alternative. Underweight bags of plant food or fertilizers are very like to boomerang to the embarrassment and expense of the manufacturer. State inspectors keep a constant vigil on the movement of products of this type and discovery of shortweights is not the best way to win the confidence of customers and the public at large.

How then can these hazards be eliminated?

Accurate weighing and bagging equipment is available to the trade. Such equipment, designed to compensate for density variations in the case of fertilizer materials and pesticides, minimizes the risks of possible give-away and also much of the possibility of short changing customers on weights.

Equipment manufacturers have devoted many years to programs of research and development. Weighing is their business and full attention is devoted to all its ramifications. Starting with the premise of accuracy, they proceed on that basis. Deviation from accuracy in favor of other elements of materials handling such as speed of operation should be on a carefully considered basis.

In obtaining accurate weights in the fertilizer industry, weighing equipment that will be affected as little as possible by density variation is of course the most suitable. The good design engineer must study very carefully the requirements of a particular weighing job. He must correctly incorporate in it features which will best provide the needed sensitivity, accuracy, speed, trouble-free reliability and other essentials.

Probably the most important single item in obtaining accurate weights is to keep to a minimum the amount of product in suspension. This refers to the product which at the time of cut-off has passed the cut-off gate but hasn't yet reached the scale bucket.

Good weighing, with accurate and economical operation, is too important to warrant the purchase of just a bagging unit as such. A considerable amount of study should go into such a decision and much thought given to producing and supplying a product to the bagging unit with characteristics that will promote efficient and accurate packaging.

It is important to make a product not only acceptable to the consumer, but also suitable for packaging. In so far as it is practical, the manufacturer of fertilizer should want to minimize the variation in density. Consideration should be given to uniformity of ingredients, accurate batching, thorough mixing, uniform particle size and shape, which contribute to better control of the product.

Good installation is necessary so the weighing unit has a fair opportunity to function under proper conditions. Good installation is an element that can hardly be over-emphasized because a well-de-

Turn to STOP LOSSES page 24

TABLE 1

Losses Incurred Through Overweight "Giveaways"

Overweight In Ounces	50 tons 80-lb. Bags	100 tons 80-lb. Bags	500-tons 80-lb. Bags
1 oz.	78 lbs.	156 lbs.	781 lbs.
2 oz.	156 lbs.	312 lbs.	1,562 lbs.
3 oz.	234 lbs.	468 lbs.	2,343 lbs.
4 oz.	312 lbs.	625 lbs.	3,125 lbs.
5 oz.	390 lbs.	781 lbs.	3,906 lbs.
6 oz.	468 lbs.	937 lbs.	4,681 lbs.
7 oz.	546 lbs.	1,093 lbs.	5,468 lbs.
8 oz.	625 lbs.	1,250 lbs.	6,250 lbs.
9 oz.	703 lbs.	1,404 lbs.	7,031 lbs.
10 oz.	781 lbs.	1,560 lbs.	7,812 lbs.
11 oz.	859 lbs.	1,716 lbs.	8,593 lbs.
12 oz.	937 lbs.	1,872 lbs.	9,375 lbs.
13 oz.	1,015 lbs.	2,028 lbs.	10,156 lbs.
14 oz.	1,093 lbs.	2,164 lbs.	10,937 lbs.
15 oz.	1,172 lbs.	2,343 lbs.	11,718 lbs.
16 oz.	1,250 lbs.	2,500 lbs.	12,500 lbs.

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PLANT MAINTENANCE

Continued from page 5

ganization are normally those with pipefitting, pipe covering, rigging, carpenter, painting, sheet metal, electrical, instrument and welding skills. These men work either in the shop or in the areas where they can be efficiently scheduled through the preventive maintenance procedure to fit their activities into those of the area mechanics. The mechanics with the primary machining skill are normally assigned to the central machine shop and very rarely perform area work.

We have found it almost a necessity to establish a maintenance control group with the responsibility for procedures, training, upgrading, scheduling and other maintenance controls. Members of the line maintenance organization are responsible for the continued functioning of the plant and as such have many immediate problems such as safety and personnel administration which require attention.

In cases where we have made the line maintenance organization also responsible for establishing the control system and long-range analysis of maintenance cost, it has been generally unsatisfactory. This is because the long-range planning is frequently set aside to "fight a fire today."

To repeat, it has been our experience that the single greatest reason for the failure of any maintenance system is the failure to establish a group whose responsibilty is the continued successful operation of the system. By its very nature any maintenance system is restricting and achieves its success from the most efficient utilization of manpower. This requires continued effort and must be continually enforced by some one with that work as his major responsibility.

2. Establish a Work Order System.

A typical work order form is illustrated herewith. This is the "contract" between operations and maintenance for specific work to be performed. It is the cornerstone of maintenance control and forms the basis for equipment records, job analysis, work scheduling, and finally, work measurement.

We issue serially numbered separate repair orders for work in execess of 4 man hours labor or $40 material charge. For lesser work we use an unnumbered patrol order form for which work is charged against the general equipment piece and account number. Patrol orders account for approximately 50% of total orders issued, but only 10% of total maintenance man hours.

A third "blanket order form" is written periodically to cover repetitive, scheduled maintenance work which can be clearly defined, such as light bulb replacement, where the total job can be accurately determined. One of the biggest leaks is the tendency to set up a great number of blanket orders and give every foreman the number so that any miscellaneous jobs can be slipped into this category. If this is done, all information of time required, work done and unusual problems is completely lost.

3. Keep Equipment Records

A typical equipment record card is also illustrated. On most plants, each piece of equipment has a separate equipment record card. It normally contains a description of the equipment, equipment and building numbers and applicable drawing numbers.

It also provides a space for the entry of maintenance performed on that piece of equipment. The information from each repair order is entered.

Where tabulating equipment is available, repair orders may be in the form of punched cards which can be conveniently stored and sorted to summarize and print maintenance costs and types of work whenever desired.

Manufacturer's manuals and guides are also maintained in this file along with copies of correspondence and other pertinent data.

4. Analyze and Plan Jobs

Each repair order must be carefully analyzed. In some plants this is the responsibility of each maintenance foreman. In others, the separate planning organization performs this work, leaving the foreman free for direct supervision, and personnel problems. In any event, the planner analyst, or foreman, must determine what is to be done, what parts are needed, and what tools and equipment to supply. He can then decide who does the work, and how many man hours it will take.

In all cases the foreman reviews and approves the analysis and estimated time, as the responsibility for performing against the estimate is his.

5. Make Weekly Forecasts

Weekly forecast sheets are likewise important. Weekly forecasting is basically an agreement between maintenance and operating departments and the maintenance control group as to the probable days of the following week when major jobs will be done. We usually start scheduling on Wednesday, using preventive maintenance schedules as a basis.

The maintenance supervisor also reviews all repair orders and major overhauls for which material is available and determines with the production supervisor the priority of jobs for the coming week. On Thursdays a weekly maintenance forecast for the following week is issued. Men assigned to patrol order and blanket order work are also listed.

On plants with good maintenance controls approximately 75% of the work can be forecast. On the forecast work, approximately 85% can be performed during the week planned.

6. Prepare Daily Schedules

Daily schedule sheets usually prepared before 3 o'clock for the following day by each foreman, schedule jobs for the following day. The sheet shows the estimated hours for each man assigned to that foreman for eight hours the following day. The estimated total hours for each job must agree with the estimate shown on the repair order.

Patrol orders are not individually listed, but several men are assigned to this work, which is shown as "Patrol Order Work." Blanket order work is individually listed for those men assigned to that work. Any work which is performed the following day which is not included in the daily schedule is listed separately below a dividing line, so that later review will indicate the amount of emergency work.

We frequently find more than 15% emergency work and have established a goal of 4% emergency work for a typical well-run plant.

7. Set Up Manpower Backlog Control

As previously stated, there are only two ways to reduce maintenance cost:

a. Reduce maintenance labor.

b. Reduce maintenance material cost.

All of the established maintenance controls fail in their purpose unless they can permit such a reduction or achieve some other end such as decreased product loss. The monthly backlog report is one which shows the crew days of work, which exists as a backlog for each craft in the area. The purpose is to compare the backlog crew days with that of previous months to determine whether the work backlog is increasing or decreasing. A crew backlog of three weeks has proven satisfactory at most of our plants.

One of our plants installed other excellent maintenance controls and procedures in November, 1954, and was working efficiently. Review of over-all maintenance costs in August, 1955, indicated a decrease in pipefitters from 21 to 16. The backlog control chart showed that the average age craft backlog had been reduced from the excessive 6 weeks to 1½ weeks which is below the optimum backlog of 3 weeks and where "fringe" maintenance work is performed. After inspection of those backlog charts, the pipefitting crew was further reduced to 14 mechanics resulting in a backlog increase to the normal 3 week amount.

PART II of
PLANT MAINTENANCE
Will appear in the next
Production Edition
February 16, 1959

Mr. Reader—Is your address correct?

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Who Should Receive The Production Edition

New Type Sparger Resistant To Corrosion, Makers State

DEVELOPMENT of an improved sparger for fertilizer mixing has been announced by Spencer Chemical Co., Kansas City, Mo. Designed to cut costs by reducing "down time" and improving product quality through better solution-acid distribution in the mixing process, the new sparger was perfected in the mixed fertilizer demonstration unit at Spencer's Jayhawk Works, Lawrence, Kansas. It is now in operation at several commercial plants.

The new design incorporates the principle of a continuous slit for distributing liquids evenly throughout the length of the sparger during the mixing process, Spencer says. Usually, pipes with holes drilled intermittently are used for liquid distribution. To protect the holes from clogging and to attempt to even out the flow of liquids, the pipes were fitted with V-shaped lips. However, due to the thin metal that must be used to fabricate them, the lips tend to corrode and give only brief service, Spencer points out.

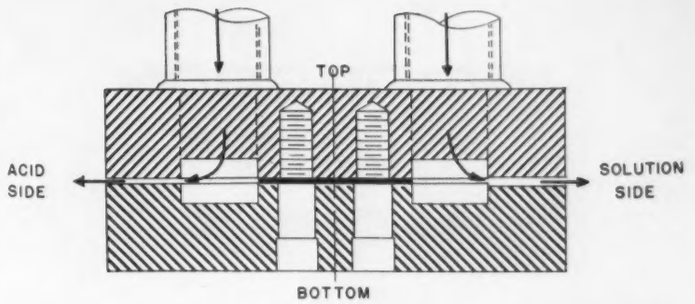
According to Joe Sharp, manager of Spencer's agricultural technical service section, fertilizer mixers experiencing difficulty in making granulated material can often trace this problem to improper liquid distribution in the mixer. "The sparger is literally the heart of the mixing process," Mr. Sharp said. "If the acid or nitrogen solutions are improperly distributed, whether through clogging of the sparger or through excessive corrosion, poor granulation will result."

He said that an accumulation of these granulation problems in the industry led Spencer to begin its experimentation with the new design. "We now have a ruggedly built sparger which, because of its continuous slit design, gives uniform distribution and resists clogging. Because of the wide area from which liquids are dispensed, corrosion occurs almost uniformly along the edges of the slit, instead of isolated areas. This helps to maintain even distribution and cuts down on 'hot spots' in the mixer which, in addition to poor granulation, can mean plant food loss, off-grade material, and air pollution."

In construction, the new sparger differs from pipe-type spargers in that a single block of metal replaces the separate acid and solution pipes. This block is fabricated from two pieces of bar metal held apart by a gasket inserted between the bars down the center and at the ends. The space formed between the bars by the gasket provides the continuous slit through which acid can flow from one side of the sparger and solution to the other. To facilitate even flow, grooves are machined into the interface of each bar. Pipes attached to the top convey acid and solution into the sparger.

Spencer technicians say that in the pipe sparger efficiency is completely lost when only ¼ in. of the metal is eroded or corroded away. More than 2 in. of metal protects the Spencer sparger from complete failure.

Mr. Sharp added that test models of the sparger had been fabricated from several different materials, ranging from carbon steel to corrosion-resistant alloys. He indicated that in all cases, the new design had performed better than the same materials used in the pipe-type spargers, causing less down time and maintenance cost. Current indications are that a carbon steel model with alloy "lips" at the edges of the slits will prove the most practical. Further information about the new sparger is available from Spencer's technical service section.



NEW TYPE SPARGER—New continuous slit sparger designed by Spencer Chemical Co. comprises two pieces of bar metal joined by bolts. Slits in the middle of each side are formed by gaskets placed down the middle of the bars and at the ends. Interfaces of the bars are machined to give a smooth, true surface and aid in even dispersion of liquid, the makers say. In addition to giving better granulation results, Spencer says the new design is less susceptible to corrosion than other models.

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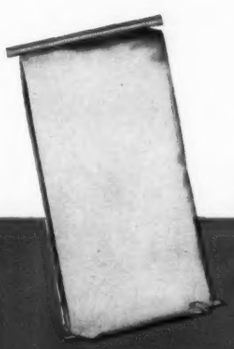

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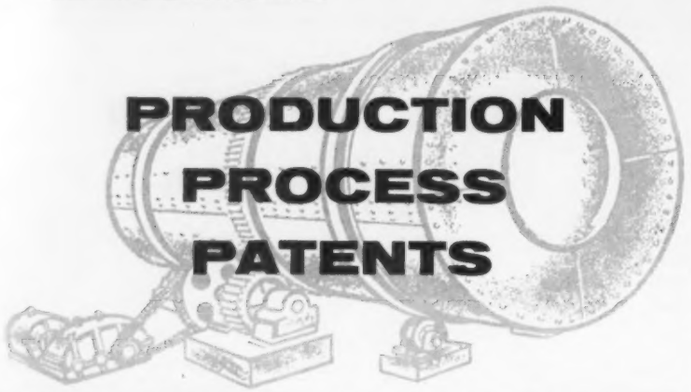


Method to Concentrate Nitric Acid Patented

A new patent was recently granted to Chemical Construction Corp., New York, covering its method of concentrating nitric acid. Designated as patent number 2,860,035, the process is described as concentrating 55-60% nitric acid to 95-99% using magnesium nitrate as dehydrating agent.

According to B. G. Mandelik of Chemico, the process is mainly advantageous in cases where sulfuric acid is either not easily obtainable or where entrainment of this acid in the product would be detrimental.

Mr. Mandelik describes the process further, as follows:

"The heat required for the evaporation of the water must be supplied under the form of steam at 250 to 350 psig. The water is absorbed by magnesium nitrate and removed from magnesium nitrate under vacuum so that the original strength of the salt would be restored. By operating under certain controlled conditions, it is possible to obtain highly concentrated nitric acid even when using a relatively short concentrating column. Materials of construction for the plant are mainly 304 stainless steel and aluminum with some items in high silicon iron and some in 20 alloy.

"A big advantage of this Chemico system is its great flexibility as far as the capacity of the units is concerned. It is easy to design a unit for any desired capacity from 5 tons per day up to a hundred TPD in a single unit.

"The utilities required apart from steam are electric current and cooling water. This method should be particularly economical where concentrations around 95% HNO_3 in the final product are required.

"The process can be described briefly as follows: Weak nitric acid (55-60%) at atmospheric temperature is pumped to the top of a concentrating column. Before entering this column, it is mixed with a stream of hot magnesium nitrate solution in such a proportion that a correct amount of heat would be supplied to the resulting mixture to flash off the nitric acid. Upon entering the column, the nitric acid is flashed off, condensed by indirect cooling and cooled in a system of indirect coolers. This acid is then stored as product acid.

"The diluted magnesium nitrate solution flows down through the column where the nitric acid is stripped from this solution by introduced steam. The nitric acid is driven towards the top of the column. The weak magnesium nitrate leaves the bottom of the column and is heated in a heat exchanger. By recirculating this hot magnesium nitrate to the reboiler section of the column, stripping steam is provided for this column.

"Part of the hot magnesium nitrate is introduced into an evaporator which is maintained under vacuum by either a steam ejector or a vacuum pump. In this evaporator, water flashes off and is condensed by direct mixing with cooling water. The concentrated magnesium nitrate solution is pumped to the top of the concentrating column where it is mixed with the weak feed acid as described above.

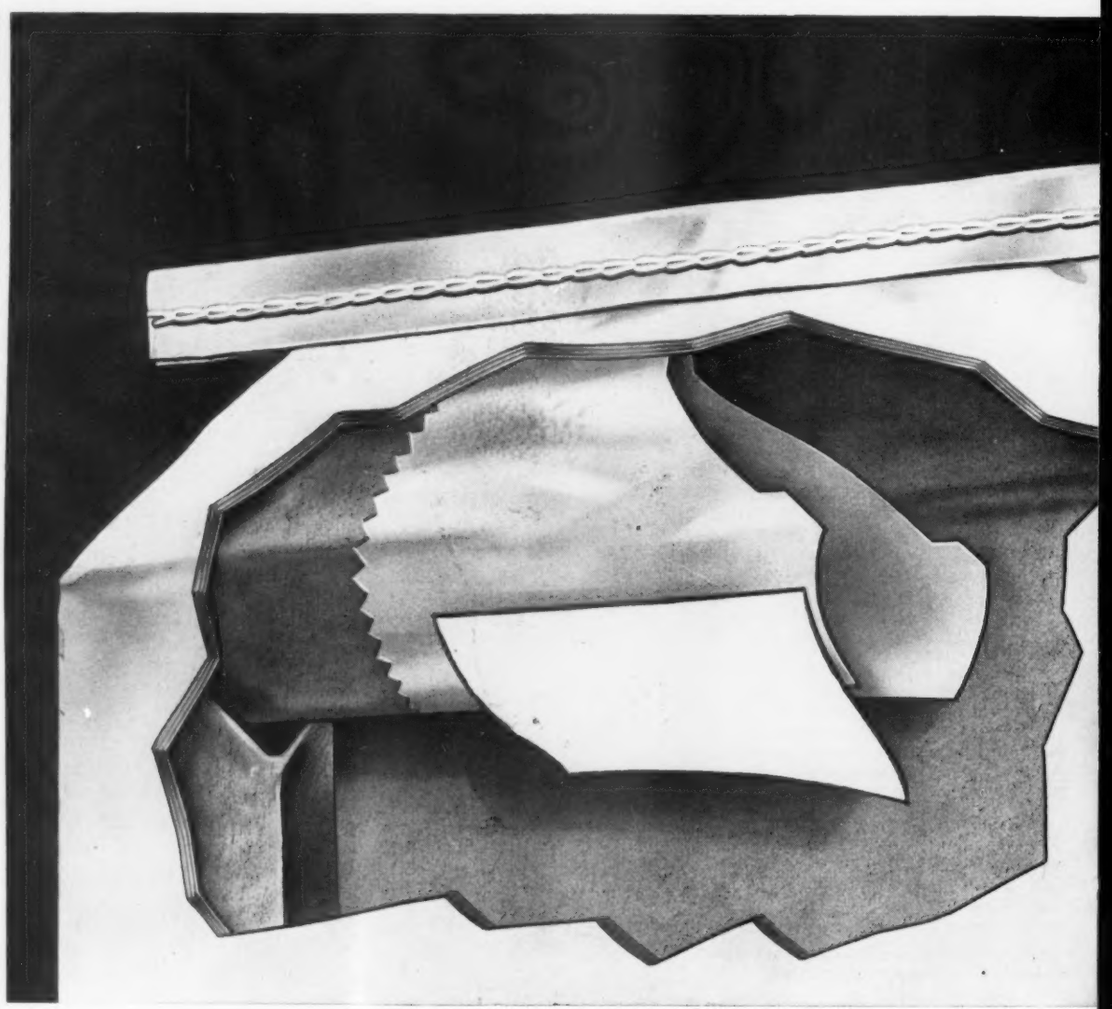
"A small reaction vessel is provided for preparation of magnesium nitrate by reacting magnesium carbonate with 60% nitric acid."

2,867,522

Method for Producing Fertilizers and Bases from Sludges. Patent issued Jan. 6, 1959, to Leroy Henry Facer, Phelps Township, Ontario County, N.Y., assignor, by mesne assignments, to Glenn C. Cooley, Schenectady, N.Y.; Warren Dunham Foster, Ridgewood, N.J., and Halfdam Gregersen, New York City, trustees. A process of manufacturing a mixed phosphatic fertilizer which also contains nitrogen, potash and magnesium and is low in chlorine which comprises passing gas from the destructive distillation of coal through a bath of sulphuric acid, the ratio of said sulphuric acid to the ammonia of the gas being such as to produce a first acidic sludge; mixing potassium chloride and sulphuric acid in proportions to evolve hydrogen chloride and to form a second acidic sludge, the amount of sulphuric acid being substantially greater than that which is necessary to produce the amount of hydrogen chloride which is evolved, mixing said first and second acidic sludges, ground phosphate rock and ground dolomite in proportions to convert the insoluble magnesium of the limestone to a soluble form and the unavailable phosphate of the rock to available forms, the concentration of said acid being such as to supply not more than the amount of water required in the acidulation reaction and the amount necessary to furnish substantially the full amount of water of crystallization for the completely hydrated product and the above operations being carried out in the absence of external heat, and curing said mixture.

2,867,649

Method of Purifying Pyrethrin Extracts. Patent issued Jan. 6, 1959, to Thomas A. Haney, Stony Brook, N.Y., assignor to Olin Mathieson Chemical Corp. A method for the purification of concentrated extracts of pyrethrum flowers in a petroleum solvent boiling within the kerosene range



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which comprises admixing such an extract with from two to four times its weight of at least one saturated aliphatic hydrocarbon containing from five to seven carbon atoms, maintaining the mixture at a temperature within the range from 0°C. to —30°C. for a time sufficient to precipitate constituents of the extract insoluble in chlorofluoromethanes and chlorofluoroethanes, separating the precipitate from the remainder of the mixture, and removing said saturated aliphatic hydrocarbon from the mixture.

2,865,710

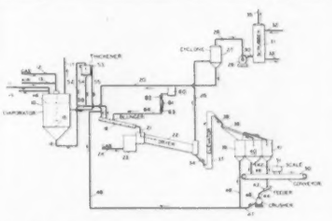
Process of Defluorination of Phosphorus Compounds. Patent issued Dec. 23, 1958, to Ira M. LeBaron, Evanston, Ill., assignor to International Minerals & Chemical Corp., Skokie, Ill. A process of preparing defluorinated phosphates a substantial portion of which are in alpha form which comprises directly introducing, for quick fusion, a fluorine-containing superphosphate, prepared by calcination at a temperature below its fusion temperature, into a mass of said material being maintained in the molten state at temperatures for phosphorus constituents in the ratio and at the rate of not more than about 15 pounds of solid feed material per minute per 100 pounds of molten material, removing at least a portion of said molten mass when homogeneous and quenching the removed portion within at least ten seconds after its removal from the molten bath.

2,865,945

Process for the Manufacture of Tetraethyl Pyrophosphate. Patent issued Dec. 23, 1958, to Jonas Kamlet, New York, assignor to National Distillers & Chemical Corp., New York. A process for the manufacture of tetraethyl pyrophosphate which comprises reacting ethyl chloride with a member from the group consisting of tetrasodium pyrophosphate and tetrapotassium pyrophosphate at a temperature of about 40° C. to about 165° C. in the presence of a catalytic amount of an iodide.

2,867,523

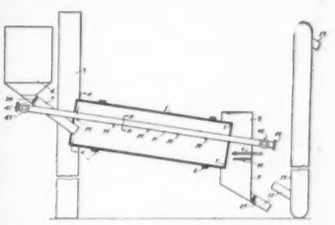
Ammonium Sulfate Production. Patent issued to William A. Lutz, Westport, and William T. Marston, Fairfield, Conn., assignors to Dorr-Oliver, Inc. In the process for producing granular ammonium sulfate particles wherein such particles are produced by concentrating and thickening an ammonium sulfate solution



to yield a magma of fine ammonium sulfate crystals, subjecting the resulting magma to agitation in an agitation zone to which fine substantially dry ammonium sulfate crystals are added in an amount sufficient to maintain an optimum moisture content sufficient to promote agglomeration of said crystals into relatively larger granules but insufficient to promote sticking together of the resulting relatively larger granules on subsequent drying, removing granules from said agitation zone, drying said removed granules, and classifying said granules into an intermediate product size fraction as well as an undersize and an oversize fraction, the undersize and oversize fractions constituting the source of dry crystals added to said agitation zone; the improvement enabling maintenance of a relatively higher moisture content in said agitation zone while increasing the yield of said intermediate product size granules therein, comprising adding ammonium hydroxide to the ammonium sulfate magma introduced into said agitation zone.

2,865,713

Manufacture of Phosphoric Acid. Patent issued Dec. 23, 1958, to Oran L. Culberson, Corpus Christi, Texas, and William A. Pardee, Fox Chapel, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa. The process of manufacturing phosphoric acid which comprises: Charging phosphate rock to a heated horizontal rotary kiln; rotating the kiln and thereby



tumbling the phosphate rock and causing it to travel longitudinally through the said kiln; maintaining the temperature in the said kiln within a range that will carbonize asphalt; successively applying and carbonizing a plurality of small increments of asphalt with the said phosphate rock during its longitudinal passage through the said kiln; discharging from the kiln an aggregate of fully carbonized asphalt and phosphate rock; charging the said aggregate to a blast furnace in the absence of added fluxing material; heating the said aggregate in the blast furnace to a temperature below 2400° F. and thereby freeing phosphorus in vapor form from the phosphate rock; oxidizing the phosphorus vapors to phosphorus pentaoxide; hydrating the phosphorus pentaoxide to phosphoric acid; and separating the phosphoric acid from accompanying gases.

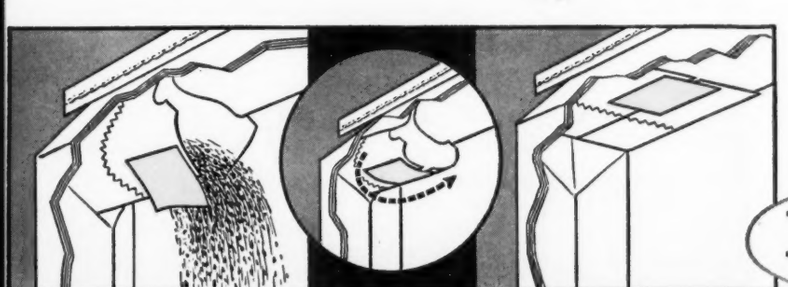
Liquid Fumigant Will Mix with Fertilizer Solutions, Makers State

To tie the growing demand for soil fumigants to the increasing use of liquid fertilizers, Shell Chemical Corp. has developed a liquid fumigant that will mix with most of the common liquid plant foods.

The main problem in developing the new mix was in finding a formulation compatible with the range of liquid fertilizers. Studies conducted at Shell's technical service laboratory in Union, N.J., and Shell Development Co.'s agricultural research division in Modesto, Cal., led to a formulation that mixes well with the fertilizers without affecting their stability.

With the liquid mix, formulations of Nemagon soil fumigant are available that can be applied jointly with all types of fertilizers. Last year the company brought out a formulation that could be coated on dry fertilizers, and prior to that it developed granular Nemagon.

multiwall sleeve valve



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WON'T CLOG . . . This view shows how the Magic Yellow check flap falls freely aside from the valve slit, giving no interference whatever to proper operation of the packing spout. The sleeve won't choke or clog the packer.

POSITIVE CLOSING ACTION . . . This diagrammatic picture shows action as the flap starts to close over the valve slit.

CAN'T SIFT . . . When the bag is filled, the Magic Yellow flap, acting as a check valve, completely overlaps and covers the valve slit, keeping the product from reaching the place where it might find a chance to sift.

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These tonnage gains have been the direct result of an increasing awareness by farmers of the role balanced fertilizer programs can play in more profitable farming. Many groups and individuals have helped.

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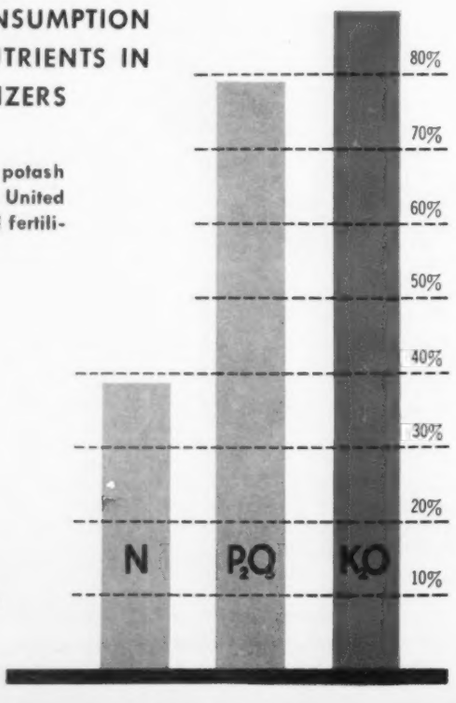
This service brings tonnage-building soil fertility facts you can use.

RELATIVE CONSUMPTION OF PLANT NUTRIENTS IN MIXED FERTILIZERS

Nearly 87% of the potash consumed in the United States is in mixed fertilizers



SOURCE
U.S. Department of Agriculture, June, 1958 (ARS 41-19-1)

WALL POSTERS

NPK Potash Institute charts, on nutrient deficiencies, plant food utilization by crops, and other soil fertility topics, have become standard sources of farm knowledge on fertilizers. These charts are available for your use, for display purposes. They will help you sell more fertilizer.

SPECIAL BOOKLETS

NPK Mail the coupon for a complete listing of special booklets. These include "Fertilizer Placement," "Hidden Hunger In Crops," "Potash Deficiency Symptoms," "Forest Fertilization," and "Potash In Agriculture." They will help you help your customers.

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NPK For use in any standard slide projector. These include "Successful Alfalfa—You Can Grow It," "Soil Fertility and Soybeans," "Potassium Hunger Signs," "Safe and Efficient Fertilizer Placement." Each set with its own narration. Excellent for dealer or customer meetings. Used by fertilizer industry, teachers and agricultural advisers for classes and farm meetings.

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NPK Keep you informed on soil fertility subjects in your area. A time-saving digest of information on subjects important in your particular region. Extra copies also available for your customers.

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NPK The American Potash Institute's magazine, "Better Crops with Plant Food," is read and studied by agricultural leaders the nation over. Articles in "Better Crops" are written by authorities in the soil fertility field. In addition to articles on the fertilization of major crops, other subjects include forest tree nutrition, lawn and turf fertilization, flower fertilization, and house plant care and fertilization. Circulation exceeds 25,000.

REPRINTS OF SOIL FERTILITY ARTICLES

NPK Reprints of soil fertility articles, appearing in "Better Crops with Plant Food," are used by the fertilizer industry as direct mail or over-the-counter fertilizer educational material. They also go to high school and college classes. Between 300,000 and 400,000 are distributed annually.

AID TO FARM PRESS, RADIO, TV

NPK Potash Institute staff members work closely with farm magazine editors, radio and television farm directors. Many articles, photos and broadcasts stressing improved soil fertility practices have been originated or aided by Institute agronomists. These articles, pictures and broadcasts help you sell more fertilizer.

FERTILIZER DEMONSTRATIONS

NPK In cooperation with official agricultural agencies, the Potash Institute supports field demonstration programs which show farmers the value of correct fertilizer usage. Check your nearby Institute representative for demonstrations in your area.

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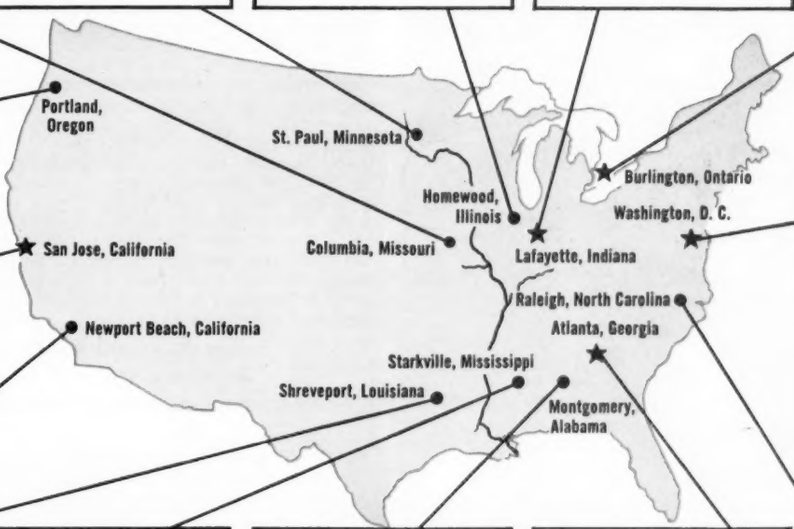

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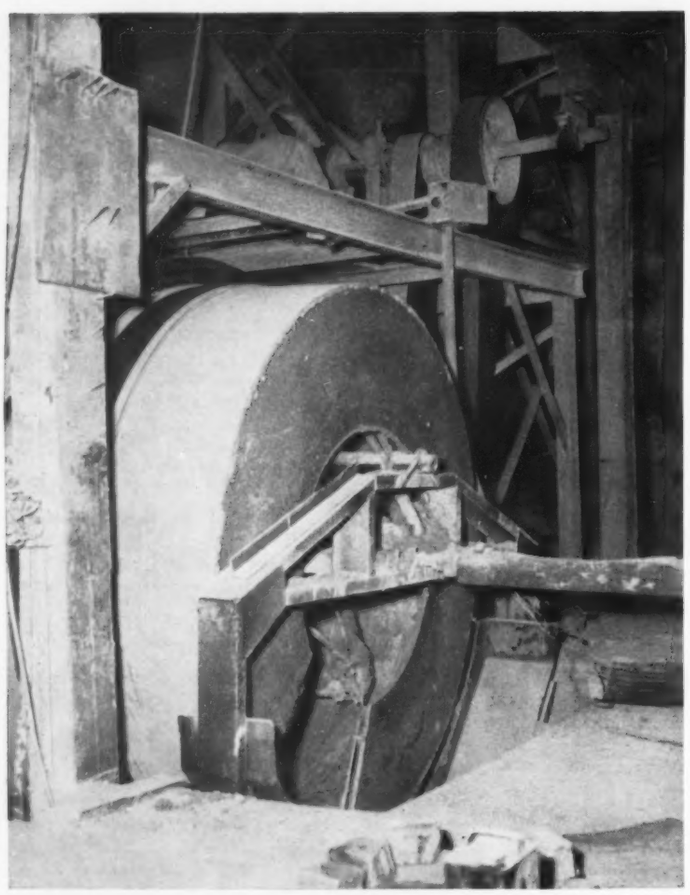
Fertilizer

GRANULATION Without Conventional Drier

Cornland Plant Foods Co., Grinnell, Ia., Utilizes TVA Continuous Ammoniator for Manufacturing by Using Cooler as Drier.

PRODUCT INSPECTION—Ray Sorenson, left, and W. W. Venable, partners in Cornland Plant Foods Co., Grinnell, Iowa, look over sample of granular fertilizer made in their plant. The men have been in business some eight years.



ONE of the first fertilizer plants in the United States to adopt for commercial use the continuous ammoniator developed by the Tennessee Valley Authority, is the Cornland Plant Foods Co. at Grinnell, Iowa. Operated by two partners, Ray Sorenson and William W. Venable, the plant produces excellent grades of granular fertilizer suitable for use in the Midwestern area where the firm operates.

The TVA ammoniator was installed early in 1955 and produces from 10 to 25 tons an hour depending upon the grade being made, according to Mr. Venable. An unusual feature of the plant is its lack of a conventional drier, which the plant operators indicate is not necessary under the system being used. In place of the drier is a rotary cooler which does a satisfactory job, the owners indicate.

Inspection of the granular material stored in bins at the Grinnell plant offers evidence of the high type of work done by the plant.

The firm ships by rail to a small extent, but mostly by truck in both bulk and in bags. Marketing is done through dealers through about two-thirds of the state of Iowa and in some adjoining states.

Mr. Venable, a native of Virginia, was earlier in business at Pocahontas, Iowa, eleven years ago and moved to Grinnell in 1950.

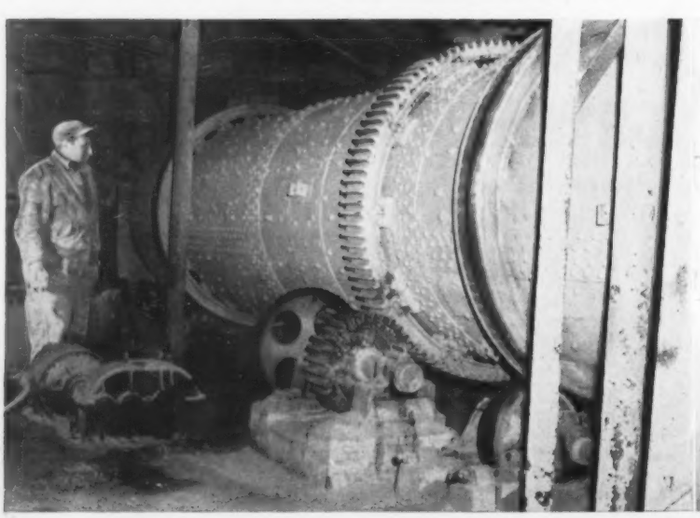
In 1951, he formed a partnership with Mr. Sorenson, a native Iowan, and established the Cornland Plant Foods Co.

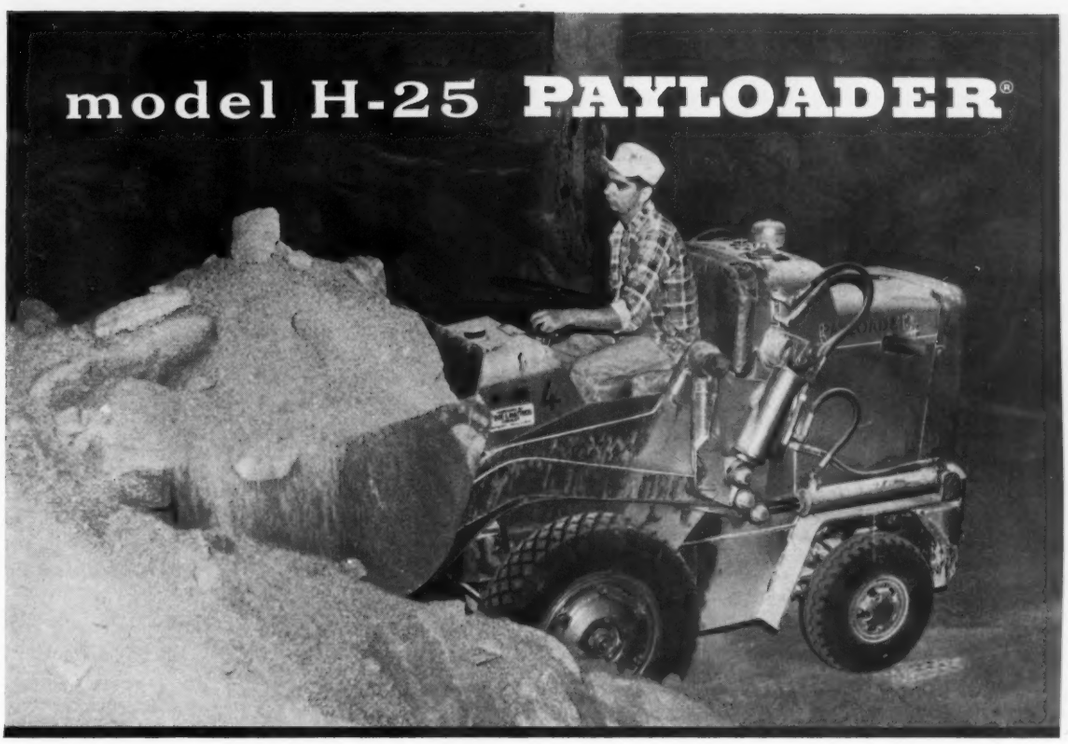
Since that time, the plant has continued to thrive and employs more than 30 persons during the busy season, plus a number of representatives on the road full time.

Describing some of their activities since taking over the Cornland plant some seven years ago, he said the original plant was a "meal type" mixer fitted for solutions. The original equipment included a one ton batch mixer. Later, the firm was licensed under Davison patents for granulating fertilizers in an older type mixer. Then in 1955, under the advice of the engineering firm of D. M. Weatherly, Atlanta, the Grinnell plant was equipped with the then new TVA continuous ammoniator.

Turn to **GRINNELL PLANT,** page 29

CONTINUOUS GRANULATION—Heart of the TVA continuous process is ammoniator seen at left in Cornland Plant Foods plant, Grinnell, Iowa. Acid and water are introduced via pipe at end. Below, left to right, is the rotary cooler which serves as a drier. Larry Wilson, plant foreman at left. Below is area where plant food ingredients enter conveyor for trip to ammoniator after having been weighed.





Competitive Tests Prove H-25 Best

Eastern States Farmers Exchange, Inc. purchased four "PAYLOADER" units as a result of competitive tests conducted at their Cambridge, Mass. plant. In these tests, a Model H-25 "PAYLOADER" moved material at a rate of 90 cu. yds. per hour on a 150-ft. (one-way) haul distance — outproduced the other tractor-shovels in the test.

This fertilizer manufacturer serves Pennsylvania, Maryland and the New England States . . . has four plants and a fifth under construction.

One way to be sure you buy the very best in tractor-shovels is to conduct competitive tests in *your own* plant under *your own* conditions. Like Eastern States Farmers Exchange, you'll find that such tests help to cut through the confusion of conflicting claims.

More For Your Money

There are many reasons why the Model H-25 will dig, carry and deliver more yardage or tonnage with lower operating and maintenance costs than anything in its class. It has more breakout force, 4,500 lbs.; equal or greater carrying capacity, 2,500 lbs.; the shortest turning radius, 72 inches; power-shift transmission with two speeds forward *and* reverse; power-steer; exclusive power-transfer differential.

An Ounce of Prevention

The H-25 has been engineered to provide extraordinary protection against dust and dirt damage: triple air cleaner — precleaner and two oil-bath air cleaners; cartridge-type oil filter on all three oil systems; sealed, self-adjusting service brakes; parking brake enclosed in transmission; special grease and oil seals on all vital points.

Why not find out what a Model H-25 can do on your work? Ask your Hough Distributor for a demonstration, and ask about Hough Purchase and Lease Plans too.

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LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
970 Sunnyside Ave., Libertyville, Ill.

Send data on new H-25 "PAYLOADER"

Name _____

Title _____

Company _____

Street _____

City _____

State _____

1-A-1

Toxic Gas Said to Arise from Pre-Neutralized Form of Urea in Plant's Ammoniation Process

By Joe C. Sharp
Spencer Chemical Co.
Kansas City, Mo.

WORK conducted at Spencer Chemical Company's mixed fertilizer demonstration unit has indicated that there is definite economic value in pre-neutralizing ammoniating solutions and sulphuric acid before they are fed into the ammoniator. Such a reaction enables the production of non-phosphate and inverted grades such as 14-0-14 and 20-10-10 without the use of dry materials.

However, it should be noted that the pre-neutralizing reaction should not be conducted with an ammoniating solution which contains urea as all or any part of its nitrogen source. Tests conducted at the mixed fertilizer demonstration unit using urea-containing solutions for pre-neutralization have indicated the following:

1. A toxic gas, which gives indication of being a cyanogen compound, probably cyanic acid, is produced when urea-containing solutions are pre-neutralized.

2. There is considerable loss of urea during the pre-neutralization reaction.

In the initial attempt to neutralize urea-containing solution, a 43% nitrogen solution which contained 6% urea by weight (20-68-6) was used. Enough water was added to cover the spargers, after which the solution and acid were introduced. No additional water was added.

At approximately the boiling point of water, a bubbling in the pre-neutralizer was noticed which had not been present in the neutralization of ammonium nitrate solutions. The temperature reached a peak of 270°F. during the short run.

When one of the operators went above the pre-neutralization tank to investigate the cause of the bubbling, he was almost overcome by giddiness and had to go outside for fresh air. Symptoms noticed were bitter taste, dizziness, burning eyes, dry throat, congested sinuses, followed by headache.

Following this, the pre-neutralizer was shut down and attempts were made to determine the cause of the trouble. A small glass pre-neutralizer was set up in the laboratory and connected to a scrubber containing dilute sodium hydroxide. Acid and solution were started and the fumes taken through the scrubber. Tests on the scrubbing solution were negative on cyanides and thiocyanates. No tests were made for cyanates.

Next, a hood and a blower were installed over the pre-neutralizer at the mixed fertilizer demonstration unit before the next run was attempted. For this run a solution containing 36.8% urea was used. A series of three gas scrubbers containing water were set up to take a small stream of exhaust gases from the pre-neutralizer to the scrubbers in an attempt to catch and identify the decomposition product.

Although the hood worked efficiently, gas from the scrubbers was sufficient to produce physiological effects on the operators. The unit was run for 30 minutes and reached a top temperature of 250°F. before leveling out.

Samples taken from the scrubbers showed ammonium carbonate and later references indicated that this was formed when cyanic acid (HCNO) reacted with water. The pre-neutralized material was analyzed and it was found that over 3% biuret had been formed and that over 4% of the urea content from the original solution could not be accounted for in the pre-neutralized solution.

So far as can be determined, this was the first attempt to pre-neutralize urea-containing solutions. The possibility of producing decomposition products from urea was considered and, although no literature references could be found, it was suspected that cyanic acid or hydrogen cyanide could be produced. This is substantiated by Werner*. "At 100°C. an equilibrium is obtained which is equivalent to 95.5 parts of urea to 4.5 parts ammonium cyanate. The presence of $(NH_4)_2SO_4$ increases the formation of NH_4CNO (ammonium cyanate)."

There are undoubtedly areas of momentary high acidity in the pre-neutralizer which would liberate HCNO (cyanic acid), which is a gas at ordinary temperature. However, a search of literature and discussion with chemistry professors at Kansas State College failed to locate any cases of cyanic acid poisoning or the poisonous properties of cyanic acid.

The one conclusion that can be drawn is that a cyanogen compound is formed in the reaction. In "Industrial Medicine and Surgery" by Mock, poisonous cyanogen compounds are listed as being: HCN (hydrocyanic

Turn to TOXIC GASES, page 28)

*John Alfonse Werner, The Chemistry of Urea.

EDITOR'S NOTE

The reader should bear in mind Mr. Sharp's comment at the end of his report that these results "should not prejudice users against solutions containing urea when it is used with conventional ammoniating equipment. As a solution component, it enables the linking of low salting-out temperature and flow free ammonia content—values which in turn enable the mixer to achieve a number of economies in granulation."

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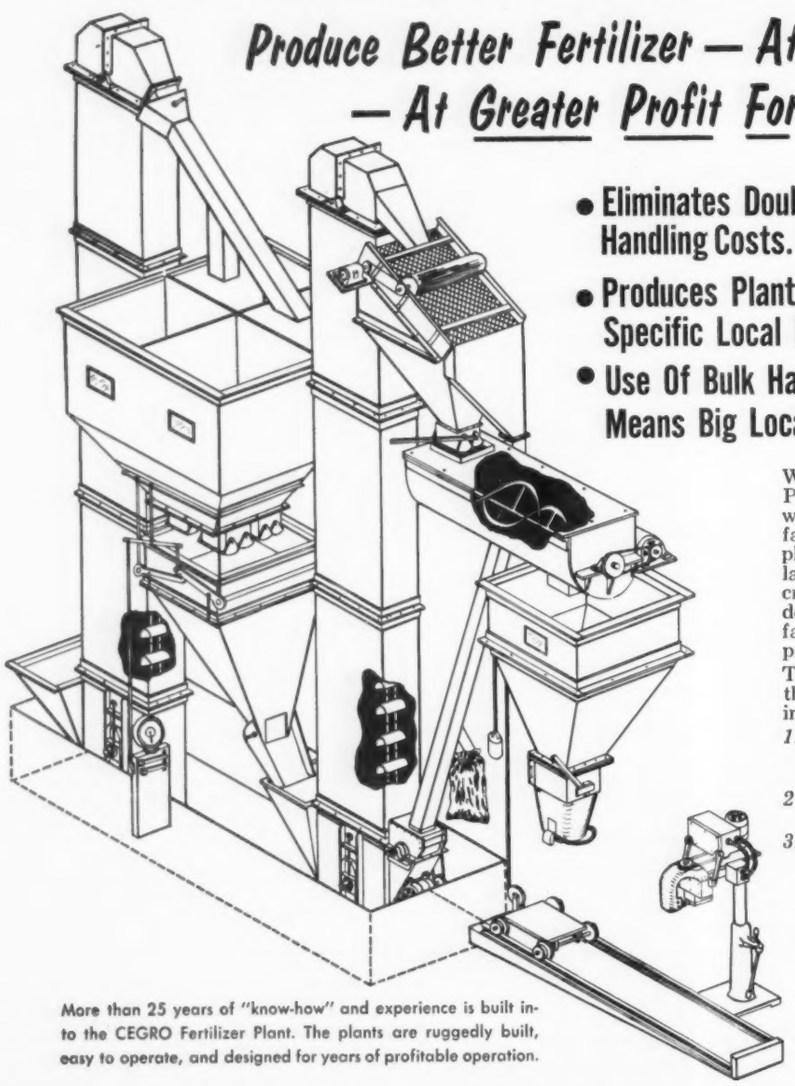

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What's New?

Additional information is available about new products, new services, and literature described in this department. Circle the numbers of items on which you desire more information, fill in your name, your job title, your company's name and address on one of the cards. Then clip it out of the page and mail. No postage is necessary. The second card is for use of your fellow-production man who might also wish to send for additional information.

No. 9006—Adsorbents

A descriptive booklet covering details on its line of adsorbents has been issued by the Floridin Co. Copy contained in the booklet includes ma-

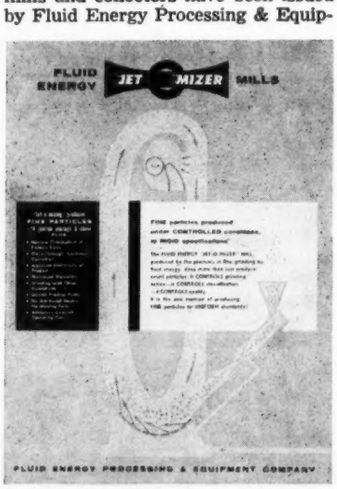
terial on the use of Fuller's earth in the agricultural chemical industry, and specific descriptions of the firm's products as used in manufacturing of pesticides, in both powder and granular forms.

Information includes screen analysis specifications; sorptive capacity and flowability control; carrier in impregnated concentrates; the materials as a milling aid and as diluents and conditioners; and their use in the formulation of granular pesticides.

The booklet may be had by checking No. 9006 and mailing the coupon to this publication.

No. 9002—Fluid Energy

Complete descriptions, photographs and flow diagrams of its reduction mills and collectors have been issued by Fluid Energy Processing & Equip-



ment Co. in a recent brochure. The six-page folder explains the utilization of fluid energy with schematic drawings and lists the chemical processes to which the equipment is adaptable. Among pesticides named in the brochure are benzene hexachloride, DDT and dieldrin. The brochure may be obtained by checking No. 9002 on the coupon and mailing.

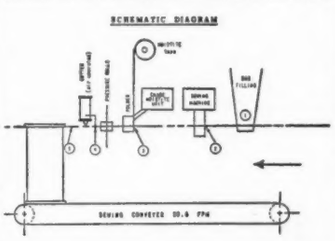
No. 9003—Tank Gauge

A system for the accurate measurement of tank and bin levels is described in a brochure issued recently by Industrial Nucleonics Corp. Covered in detail are devices for sounding alarms when the level of liquid or solid materials rises above or falls below a pre-determined point. In addition, the system may be used to provide a signal for automatic control of the material within a pre-set band. With liquid materials in a tank, accuracies up to ⅛ in. of target level are obtainable, the makers state. The catalog contains illustrations of devices with diagrams and cut-aways for illustrative purposes.

To get a copy of the catalog, check No. 9003 on the coupon and mail to this publication.

No. 9011—Bag Closures

Chase Bag Co. has issued information on its "Moistite" closures of interest to fertilizer manufacturers. As



indicated by the schematic drawing, the bag moves from right to left on the conveyor through the bag-filling unit, the sewing machine is started via switch tripped by moving bag, and then to the unit which applies adhesive tape just before folder is reached. Tape is fed through by pressure rolls. As front edge of the bag passes the rolls, it trips cutter which trims excess lead tape from the bag and the trailing edge actuates the cutter again to cut trailing tape at that end. At the end of the belt, the bag trips the contact as it leaves the cutter and shuts down the sewing machine, the "moistite" unit and pressure rolls.

Check No. 9011 on the coupon and mail, for further information.

No. 9008—Flowmeters

Technical information on magnetic flowmeters has been published by the Foxboro Co. in a recently-issued booklet. Photographs, cut-away diagrams and schematic drawings show the workings of the metering devices, and written copy describes the principles on which the meters operate. A table is presented giving metering transmitter specifications based on line size, type of metering tube and liners required for liquids at stated thickness, temperatures, pressures and gallons-per-minute flow rate. For a copy of the specifications check No. 9008 on the coupon and mail it to this publication.

No. 9000—Bagging Cost Calculator

A "bagging cost calculator" has been devised by Union Bag-Camp Paper Corp. as a quick method of calculating costs per ton for filling bags of 50, 80 and 100 lb. at various per hour labor rates. Instructions on the calculator tell the user to set the scale at the number of bags filled a minute and the number of men. Other sections of the calculator give the labor cost per ton of packaged product at the hourly rate of operators and the size of bags involved.

To receive a calculator, check No. 9000 on the coupon and mail it to this publication.

No. 9009—Speed Reducer

Introduction of the new "Shaftex" shaft-mounted speed reducer in sizes up to 40 h.p. and with nominal internal gear ratios of 5 to 1, 15 to 1, and 20 to 1 has been announced by Allis-Chalmers. Full description is made of its construction and operating features in a new bulletin.

A completely enclosed unit for direct mounting on the driven shaft, the reducer is available in single and double reduction units. The makers say it can be easily adapted without disassembly to include back stops where reverse rotation is prohibited and overload releases for chokable conditions.

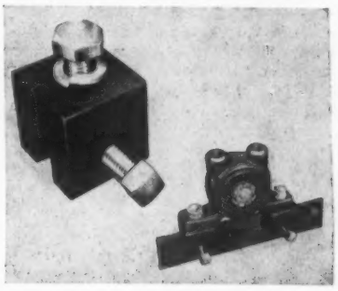
The reducer is usually driven by a fixed pitch diameter texrope drive. Variable speeds can be obtained by using either stationary control or motion control Vari-Pitch sheaves.

For a higher degree of positive ratio transmission, the reducer can be operated with a timing belt drive. The "Shaftex" reducer's flexibility and simplicity are claimed to result in substantial savings in space and weight.

Check number 9009 on the coupon for further information.

No. 9004—Vibrators

A new mounting system for vibration inducers has been developed by Martin Engineering Co., to enable manufacturers to find the most effective location for vibration inducer in minutes, without the necessity of welding or cutting. The makers state that the clamping mount blocks are useful for any type of hopper or chute operation. They state that the clamping blocks are easy to install either



temporarily or permanently, in any of the more than 20 sizes and models in the firm's "Vibrolator" line.

Mounts can be attached or removed with a standard wrench on the two set screws. Detailed information is available from the makers. Check No. 9004 on the coupon and mail.

No. 9005—Steel Drums

Bennett Industries, Inc., has prepared a convenient file folder giving full specifications with drawings on

Send me information on the items marked:

- ☐ No. 9000—Bagging Cost Calculator
- ☐ No. 9001—Plastic Handle Grip
- ☐ No. 9002—Fluid Energy Mills
- ☐ No. 9003—Tank Measurement
- ☐ No. 9004—Vibration Inducers
- ☐ No. 9005—Steel Drums
- ☐ No. 9006—Adsorbents Booklet
- ☐ No. 9007—Materials Storage
- ☐ No. 9008—Magnetic Flowmeters
- ☐ No. 9009—Speed Reducer
- ☐ No. 9011—Bag Closures

NAME .....

POSITION ..... ☐ Fertilizer Mfr. ☐ Pesticide Mfr. ☐ Both ☐ Other

COMPANY .....

ADDRESS .....

CITY ..... ZONE.... STATE.....

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Croplife

P.O. Box 67

Reader Service Dept. Minneapolis 40, Minn.

its universal standard 55-gal. steel drum line, with both open and closed heads. Information is offered on the firm's "Dura-Prime" process for cleaning and phosphating drums to inhibit rust and corrosion and for paint and lining adhesion. Further information is available by checking No. 9005 on the coupon and mailing it in.

No. 9007—Storage Plan

A new case history bulletin that describes and illustrates how warehouse space was increased 20% and the working force decreased by 33% through the use of palletized handling of kegs and multi-sized cartons, has been published by Lewis-Shepard Products, Inc.

The six-page, two-color presentation has nine photos, showing the step-by-step procedure followed, and complete specifications of pallet sizes, stacking heights, and equipment necessary to effectively utilize a system of palletized loads.

Check No. 9007 on coupon for a copy of the bulletin.

No. 9001—Plastic Handle

Vulcan Containers, Inc., offers a new plastic handle grip for steel shipping pails to reduce possible abrasion damage in transit to lithographed, decorated or paint finish. The makers state that the new plastic grip is comfortable to handle and will neither break nor splinter. The new grip, its makers claim, is highly resilient and will not scratch, dent, nor mar either the pail to which it is attached nor adjacent pails. The grip was designed by Vulcan to replace wooden or metal grips, after extensive tests by an independent laboratory.

For further detailed information on the grips, check No. 9001 on the coupon and mail.

STOP LOSSES

Continued from page 13

signed and carefully-produced weighing unit may function improperly if poorly installed.

Careful consideration should be given to a firm foundation and to the adverse effect of excessive vibration. Space limitations frequently affect the full utilization of the equipment's features. Arrangements should be made to avoid load shocks as much as possible to retain stability which was built into the weighing unit and to avoid upsetting the alignments and adjustments.

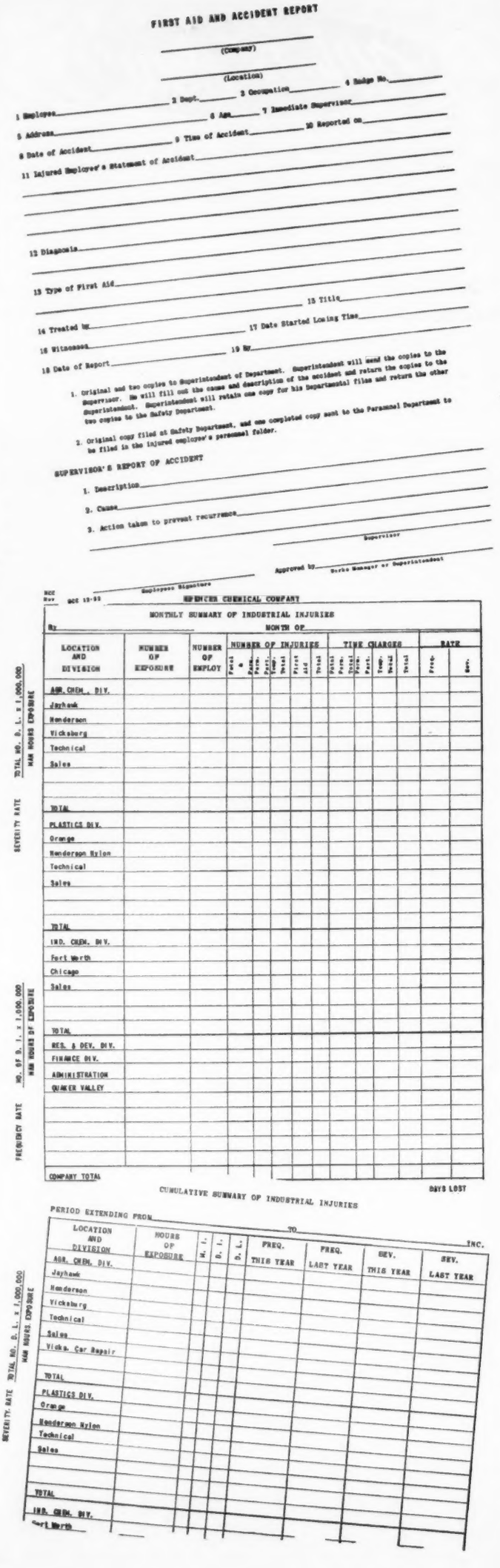
Frequent testing and maintenance are a must for good performance. Adverse external conditions such as dust, corrosion, etc., repress the freedom of working parts and, like any machine with constant use, its parts may become worn and deteriorated. But if periodic testing and maintenance are performed, the weighing unit should give years of satisfactory operation.

Supervision should not be overlooked. It includes not only the supervision of weighing personnel but of the weighing practices, the equipment itself, and the conditions under which it is operating. Supervision should be done by well-trained people who can and will recognize unsatisfactory conditions and are capable of taking the necessary action to correct them.

Manufacturers not sure of their weighing equipment should re-appraise their present setups. What makes for good weighing?

First, bagging equipment should be selected that has been designed to minimize the effects of product variation. Keeping a minimum of product in suspension at the time the weights are finished is important in combatting density variation.

Second, management and supervision in the fertilizer industry are responsible for careful study of product improvement, inspection and maintenance of the weighing unit.



FIRST AID AND ACCIDENT REPORT

(Company)

(Location)

1 Employee 2 Dept. 3 Occupation 4 Badge No.

5 Address 6 Age 7 Immediate Supervisor

8 Date of Accident 9 Time of Accident 10 Reported on

11 Injured Employee's Statement of Accident

12 Diagnosis

13 Type of First Aid

14 Treated by 15 Title

16 Witnessed 17 Date Started Losing Time

18 Date of Report 19 By

1. Original and two copies to Superintendent of Department. Superintendent will send the copies to the Supervisor. He will fill out the cause and description of the accident and return the copies to the Superintendent. Superintendent will retain one copy for his Departmental files and return the other two copies to the Safety Department.

2. Original copy filed at Safety Department, and one completed copy sent to the Personnel Department to be filed in the injured employee's personnel folder.

SUPERVISOR'S REPORT OF ACCIDENT

1. Description

2. Cause

3. Action taken to prevent recurrence

Supervisor

Approved by Works Manager or Superintendent

Employee Signature

NCC Rev. oct 12-55

SPENCER CHEMICAL COMPANY

MONTHLY SUMMARY OF INDUSTRIAL INJURIES

By MONTH OF

LOCATION AND DIVISION	NUMBER OF EXPOSURE	NUMBER OF EMPLOY	NUMBER OF INJURIES: Fatal	Perm. Part.	Temp. Total	Total	First Aid	Total	TIME CHARGES: Fatal	Perm. Total	Perm. Part.	Temp. Total	Total	RATE: Freq.	Sev.
AGR. CHEM. DIV.															
Jayhawk															
Henderson															
Vicksburg															
Technical															
Sales															
TOTAL															
PLASTICS DIV.															
Orange															
Henderson Nylon															
Technical															
Sales															
TOTAL															
IND. CHEM. DIV.															
Fort Worth															
Chicago															
Sales															
TOTAL															
RES. & DEV. DIV.															
FINANCE DIV.															
ADMINISTRATION															
QUAKER VALLEY															
COMPANY TOTAL															

TOTAL NO. D. L. X 1,000,000 MAN HOURS EXPOSURE — SEVERITY RATE

NO. OF D. L. X 1,000,000 MAN HOURS OF EXPOSURE — FREQUENCY RATE

DAYS LOST

CUMULATIVE SUMMARY OF INDUSTRIAL INJURIES

PERIOD EXTENDING FROM TO INC.

LOCATION AND DIVISION	HOURS OF EXPOSURE	M. I.	D. I.	D. L.	FREQ. THIS YEAR	FREQ. LAST YEAR	SEV. THIS YEAR	SEV. LAST YEAR
AGR. CHEM. DIV.								
Jayhawk								
Henderson								
Vicksburg								
Technical								
Sales								
Vicks. Car Repair								
TOTAL								
PLASTICS DIV.								
Orange								
Henderson Nylon								
Technical								
Sales								
TOTAL								
IND. CHEM. DIV.								
Fort Worth								

TOTAL NO. D. L. X 1,000,000 MAN HOURS EXPOSURE — SEVERITY RATE

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- ☐ No. 9005—Steel Drums
- ☐ No. 9006—Adsorbents Booklet
- ☐ No. 9007—Materials Storage
- ☐ No. 9008—Magnetic Flowmeters
- ☐ No. 9009—Speed Reducer
- ☐ No. 9011—Bag Closures

NAME .....

POSITION ..... ☐ Fertilizer Mfr. ☐ Pesticide Mfr. ☐ Both ☐ Other

COMPANY .....

ADDRESS .....

CITY ..... ZONE.... STATE.....

body affected by injuries is valuable in special safety campaigns. This would have an effect on whether employees should wear goggles, have hand protection, wear safety shoes, or be supplied with other safety equipment.

The following items are important to remember in formulating a good accident reporting system:

1. Keep the reports short that are sent to top management and supervision. They should also be factual, readable, and comprehensive, well illustrated with bar graphs and charts. Lengthy statistical reports should be avoided.

2. Keep honest records.

3. Records are effective only in direct proportion to the use made of them.

4. Always remember that accident reporting is the accounting system of a safety program.

John E. Smith

Complete Records Needed for Safety Program in Plant

By John E. Smith
Spencer Chemical Co.
Pittsburg, Kansas

A good safety program must have accurate and complete reports for the record. Just as any business enterprise must have good accounting, the safety program in a fertilizer plant cannot operate efficiently without maintaining adequate records.

A certain amount of accident reporting is necessary in order to give a clear, factual report of what a plant's accident experience really is and what might be done for improvement.

Although it need not be elaborate, some type of first aid and accident report is a necessity. It is desirable to get the injured employee's version of the accident before the supervisor investigates the accident. All other information necessary to make out state and insurance reports should also be obtained at this time. After the supervisor makes his report of the accident, the injured employee should sign the report.

Once each month, a complete tabulation of all accidents should be summarized on a single report. It is always desirable to include a breakdown showing the plant, division, section, or any other designation that might fit the specific operation. This chart should include man hours of exposure, the number of employees involved, and a complete breakdown of types of accidents and time charts as well as the frequency and severity rates.

To bring top management and supervision up to date each month, a cumulative summary should be given to show the accident experience for the past portion of the calendar year. Trends can be noted by pointing out comparisons of any portion of the current calendar year with the similar portion of the preceding year. It has also been found desirable always to show the formulas for arriving at frequency and severity rates, so that no confusion will arise from this area.

Cause-and-type reports are also of vital importance to spot accidents and trends and to prevent recurrences.

A record showing the parts of the

SAFETY RECORD FORMS—At left are copies of accident reports used by Spencer Chemical Co. in recording and summarizing particulars of mishaps in company's plants. Top is initial report, middle form is a monthly summary and at the bottom a cumulative record of all lost time accidents over a given period of time.

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SOHIO / hub of the highballers

Center of 5 rail systems puts Sohio products plant-side fast . . . dependable, low cost, convenient

Sohio's fleet of modern tank cars highball down a network of 5 different rail lines . . . write a super-speed delivery story in every corner of Sohioland. This strategic location and up-to-the-minute equipment make Sohio a specialist in quick-time delivery of nitrogen products.

Sohio's tank car specifications are tailored to meet your specific requirements. Top and bottom unloading aluminum and steel cars provide aqua ammonia service . . . special aluminum cars with spring-loaded safety valves handle nitrogen solutions. Sohio cars carry the latest safety devices . . . and Sohio-trained personnel inspect and maintain the tank cars to assure top mechanical condition and quality control every mile of the way. Important too, Sohio is alert to the development of new equipment that means further improvement in Sohio service.

Or if you take delivery by truck, Sohio's fleet rolls on call, arrives on time . . . trucks are self-unloaded and the Sohio trained driver can handle the hook-up and unloading alone.

See the man from Sohio first for high quality anhydrous ammonia—aqua ammonia—coated 45% or uncoated 46% urea—18 nitrogen solutions, including all urea types.

. . . we're serious about SERVICE at Sohio

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PHONE: CAtherine 5-8015

SOHIO

PRODUCTION Man of the Month

Frank S. Walters—45 years on the job.

IMC Superintendent Sees Many Changes in 45 Years

A PRODUCTION superintendent who has been close to the fertilizer trade for more than 45 years, nearly half the age of the industry itself, is Frank S. Walters of International Minerals & Chemical Corp.

Presently carrying the title of production supervisor in charge of output at IMC's eleven northern plants manufacturing fertilizers and farm chemicals, Mr. Walters has come up through the ranks of the company and has had ample opportunity to observe, at first hand, most of the technical innovations which have characterized the industry during the past decade or so.

Developments from relatively simple mixes of plant food carrying only a small percentage of actual nutrient value, to present-day complex granular products of high analysis have been observed from a first-hand vantage point by this superintendent who has experienced so many years in comparing manufacturing methods then and now.

Mr. Walters joined IMC in 1913 as a clerk in East Point, Ga. Company officials, noting his abilities, later promoted him to foreman at the Columbus, Ga., plant and later still to a spervisory position at IMC's plant at Augusta, Ga. Having made good in this promotion, he was later transferred to Chicago and the position he now holds.

In recognition of his work with the company during the past nearly half-century, Mr. Walters last summer was presented the company's 45-year merit pin by Thomas M. Ware, president.

For the past nine years, Mr. Walters and his wife have lived in Evanston, Ill., a northern suburb of Chicago. The Walters have two married daughters and five grandchildren. Mr. Walters is active in his church and in various civic and fraternal organizations in addition to his devoting full working time to his production responsibilities at IMC.

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NEUTRAL SOLUTION LIQUID FERTILIZER UNITS

THE B&L AUTOBATCH SKID PLANT
The ultimate in batch-type liquid fertilizer processing. The B&L Complete Auto-batch Skid Plant is fully automatic, factory assembled — designed as a "Complete package" for ready installation by connecting raw material and discharge lines, and electrical connection. It provides a complete installation with a minimum of auxiliary equipment required.

Now PRODUCE HIGH QUALITY BALANCED LIQUID FERTILIZERS ECONOMICALLY, PROFITABLY and ACCURATELY with the EXCLUSIVE B&L PROCESS.

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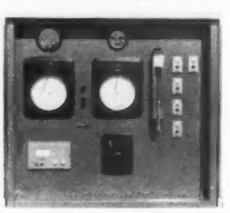
Whatever type of plant you need for profitable liquid fertilizer operations . . . Call on B&L. By utilizing B&L "Package Units" in various combinations and arrangements, B&L engineers can meet every requirement whether it be a new installation or a modernization of existing facilities. Tell us your requirements.

THE "B&L CONVERTOR"
Automatic or manually controlled liquid nitrogen "package units" for converting anhydrous ammonia to aqua ammonia.



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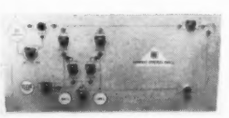
High capacity continuous flow neutral solution liquid fertilizers processing unit. Exclusive B&L instantaneous reaction acid neutralization process provides a complete high out-put liquid fertilizer installation at low plant investment.



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NEWS DIGEST OF THE WEEK

Plant Blast Kills Man

PRAIRIE DU CHIEN, WIS.—One man was killed and another injured in an explosion at the fertilizer plant of Wisconsin Farmco Service Cooperative Co. here Jan. 8. The dead man was Raymond Phillip, a plant employee. Injured in the blast was Joseph Matousek. According to reports, a quarter-full tank of ammonium nitrate solution exploded, ripping out a large section of the plant wall. Jack Sauerbry, plant foreman and Leo Moon, another employee, escaped injury. Early estimates put the loss at about $100,000.

New Superintendent

TUPELO, MISS.—Harry E. Moxley has been named superintendent of International Minerals & Chemical Corp.'s fertilizer plant at Tupelo, Miss. He succeeds T. L. Holland, who has retired in accordance with the company's pension program after 33 years with IMC.

H. E. Moxley

Mr. Moxley, who had been assistant superintendent at the Tupelo plant since 1954, joined International in 1951 upon graduation from Alabama Polytechnic Institute. He has also worked in IMC plants at Spartanburg, S.C., and Montgomery, Ala.

Sulfur Recovery Plant

TOLEDO, OHIO—A $150,000 sulfur recovery plant has been put into operation by Sun Oil Co. here. The plant will convert hydrogen sulfide gas to sulfur dioxide and thence to elemental sulfur by use of a bauxite catalyst. The facility is capable of recovering up to 12½ long tons of sulfur a day. The product will be stored in a molten state and shipped to industrial customers in special tank trucks.

PCA Names Superintendent

CARLSBAD, N. M.—Potash Company of America has named R. R. Knill general superintendent for the company. He was previously the firm's mine superintendent for the past 13 years. In addition to his duties at Carlsbad, he will supervise PCA's potassium sulfate operation at Dumas, Texas. David Rice wil succeed Mr. Knill as mine superintendent.

New Liquid Plant

POSEYVILLE, IND.—A 100-ton-a-day liquid fertilizer plant has been installed here by the Poseyville Grain & Feed Co.

Model Bill Proposed

A model bill to regulate the labeling of hazardous substances has been prepared by four associations composed of manufacturing firms. The bill is designed for either federal or state legislation. Associations backing the proposal are: The Manufacturing Chemists' Assn., Inc., Washington, D. C.; Chemical Specialties Manufacturers Assn., New York; National Paint, Varnish & Lacquer Assn., Washington, and American Petroleum Institute, New York.

Made Plant Manager

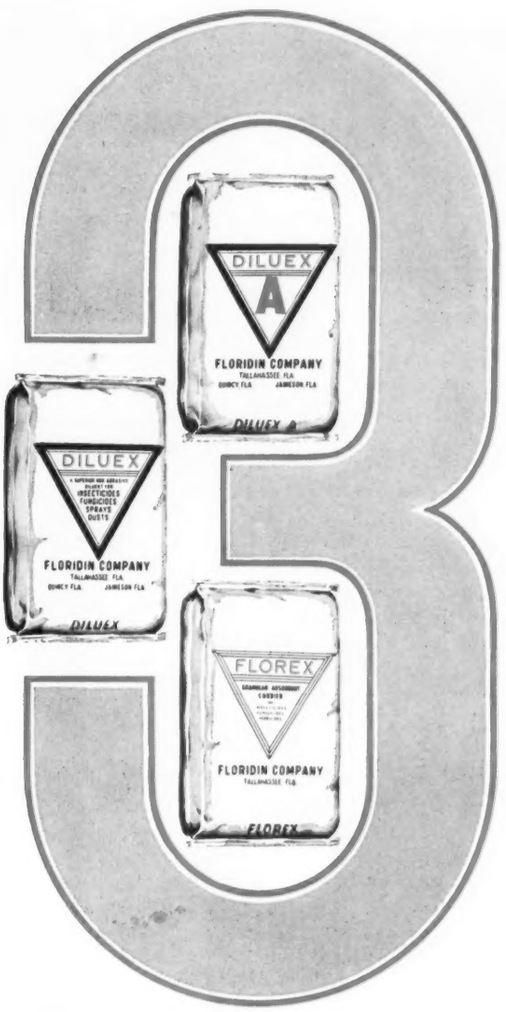
NEW ALBANY, IND.—William H. Martin has been promoted by W. R. Grace & Co. to manager of its New Albany plant of the Davison Chemical Div. He succeeds Joseph L. Gayle who retired after 36 years in the fertilizer business. Mr. Gayle will now make his home in Falmouth, Ky.

New Acid Plant

ST. PAUL, MINN.—A $1.3 million sulfuric acid plant is scheduled for completion in October, 1959, at the Pine Bend industrial development area on the Mississippi River west of Hastings, Minn. The plant will be erected for North Star Chemicals, Inc. It will have a capacity of 240 tons sulfuric acid a day.

Changes Corporate Name

NEW YORK — A new name, Sinclair Petrochemicals, Inc., has been given to the former Sinclair Chemicals, Inc. firm. Only the name has been changed, according to John A. Scott, president.



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Industry Meetings

Jan. 21—Second Annual Arizona Fertilizer Conference, University of Arizona, Tucson, Ariz.

Jan. 21-23—Southern Weed Conference, 12th annual meeting, Washington-Youree and Captain Shreve Hotels, Shreveport, La., Dr. Walter K. Porter, Jr., secretary-treasurer.

Jan. 21-22 — Northwest Agricultural Chemicals Industry Conference, Benson Hotel, Portland, Ore.; George Kitzmiller, Pacific Cooperatives, Portland, conference chairman.

Jan. 27-28 — Insecticide-Fungicide Conference, Kellogg Center, Michigan State University, East Lansing, Mich.

Jan. 29-30 — Colorado Agricultural Chemicals Assn., Cosmopolitan Hotel, Denver; D. E. Garrison, Box 623, Greeley, Colo., secretary.

Feb. 4—Fertilizer Salesmen's Training School, National Plant Food Institute, Columbus, Ohio.

Feb. 10-12—Agricultural Chemicals Conference, sixth annual meeting, Texas Technological College, Lubbock, Texas.

Feb. 12-13—Midwestern Agronomists-Fertilizer Industry Representatives, 11th annual meeting, Edgewater Beach Hotel, Chicago, Ill., sponsored by National Plant Food Institute.

Feb. 13—National Safety Council, executive committee of the fertilizer section, winter meeting, Heart of Atlanta Motel, Atlanta, Ga.

Feb. 13-18 — Maryland Agricultural Pesticides Conferences; at Salisbury State Teachers College Feb. 13, La Plata Feb. 16, and Frederick Feb. 18.

Feb. 24-25 — Alabama Pest Control Conference, Alabama Polytechnic Institute, W. G. Eden, Secretary-Treasurer, Alabama Association for Control of Economic Pests, Alabama Polytechnic Institute, Auburn, Ala.

March 4-5—Annual Weed and Insect Conference, Fonner Park, Grand Island, Neb.

March 17 — Western Agricultural Chemicals Assn. spring meeting, Hotel Miramar, Santa Barbara, Cal.; C. O. Barnard, executive secretary.

June 9-10—Seventeenth Annual Convention of the Association of Southern Feed and Fertilizer Control Officials, Velda Rose Motel, Hot Springs, Ark.; Maurice Rowe, Virginia Department of Agriculture, 1122 State Office Bldg., Richmond 19, Va.

June 14-17—National Plant Food Institute, Annual Convention, the Greenbrier, White Sulphur Springs, W. Va.

July 7-9 — Pacific Northwest Plant Food Assn., 10th Annual Regional Fertilizer Conference, Tacoma, Wash.

Nov. 4-6—Fertilizer Industry Round Table, Mayflower Hotel, Washington, D.C.; Dr. Vincent Sauchelli, National Plant Food Institute, chairman.

CALENDAR FOR 1959-60

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That's why Chase supplies Multiwalls in such wide variety, in so many types and constructions . . . why the many Chase options—in papers, tapes, sewing—permit precise, money-saving selection.

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TOXIC GAS

Continued from page 22

acid, prussic acid), NaCN (sodium cyanide) and SCN (rhodanic). Listed as symptoms are: Vertigo, headache, rush of blood to head, oppression of chest, palpitation of heart, and a sensation of constriction of throat—most of which were experienced by the operators during pre-neutralization of urea solution.

The mechanism of the reaction can be assumed as follows:

$$2\,CO\begin{matrix}NH_2\\NH_2\\ \text{urea}\end{matrix} + \text{heat} \longrightarrow HCNO + NH_3 \quad \text{(cyanic acid)}$$

The cyanic acid under the right conditions may react with urea to form biuret as indicated below:

$$HCNO + C{=}O\begin{matrix}NH_2\\NH_2\end{matrix} \longrightarrow C{=}O\begin{matrix}NH\\C{=}O\\NH_2\end{matrix} \quad \text{(biuret)}$$

or it may, under hot acidic conditions, be liberated to the air. There is a possibiilty that HCN (hydrocyanic acid) was also formed. Whatever the toxic material was, it was regarded as being a dangerous operation.

The unfavorable results in the pre-neutralization reaction should not prejudice users against solutions containing urea when it is used with conventional ammoniating equipment. As a solution component, it enables the linking of low salting out temperature and flow free ammonia content—values which in turn enable the mixer to achieve a number of economies in granulation.

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GRINNELL PLANT

Continued from page 20

Mr. Venable recalls that this equipment was installed in only three weeks while the firm continued delivering fertilizer materials from its full bins during the month of February.

The TVA-licensed ammoniator was built according to the original specifications of the TVA. Under this system, the product is cooled as it dries. No artificial heat is added, the system utilizing the heat made from the ammoniation process itself.

The company keeps its key force of workers busy the year around. This crew comprises 11 men including a foreman and superintendent. The superintendent is James R. Lincoln and foreman is Larry Wilson, both of whom have been with the firm for a number of years.

Heat in the ammoniator runs from 180° to 250° and this heat, in combination with the action of the cooler, dries out the materials satisfactorily, thus cutting drying costs. The plant owners, however, recognize the fact that although economies are gained in the drying process, the formulation costs are increased somewhat by the necessity for using additional amounts of acid to create the heat.

The partners are thoroughly sold on the value of soil testing and work closely with Iowa State College in getting information to farmers in their marketing area concerning the testing of soils. "We are working in every way we know to further the soil testing program," says Mr. Venable.

"We have initiated a program in which we send all available information to dealers to encourage their customers to make soil tests." The manufacturers added that they send out Iowa State bulletins to dealers in loose-leaf binder form so that additional copies may be used and data brought up-to-date as new developments come about.

"We work together with both the Tennessee Valley Authority and Iowa State College for higher analysis goods of better quality," Mr. Venable went on. "We think the TVA has done more for the technical side of the fertilizer industry than anything else has ever done." Both he and Mr. Sorenson emphasized the fact that they encourage every program that Iowa State College undertakes, particularly with emphasis on taking soil samples, and minimum fertilization recommendations put out by the college. In many cases, the partners agreed, recommendations should be even higher than they are and the firm is working toward this end.

In the manufacturing process, Cornland does not use phosphoric acid but diammonium phosphate instead. The latter, they say, is admittedly more expensive but in their opinion offers a sounder program of manufacturing in their size plant. The plant owners add that they are not opposed to the use of phosphoric acid and are indeed considering its use at a later time. The economics of the situation will probably dictate the final decision, they indicate.

In speaking of the fertilizer manufacturing process without the benefit of artificial drying, Mr. Venable recalls that there was at first a great deal of skepticism on the part of the industry about the omission of a drier. "Many said that this simply couldn't be done, but we are doing it every day," Mr. Venable says. The economics, he added, are in favor of the process being used currently in the plant.

Classified Ads

Classified advertisements accepted until Tuesday each week for the issue of the following Monday.

Rates: 15¢ per word; minimum charge $2.25. Situations wanted, 10¢ a word; $1.50 minimum. Count six words of signature, whether for direct reply or keyed care this office. If advertisement is keyed, care of this office, 20¢ per insertion additional charged for forwarding replies. Commercial advertising not accepted in classified advertising department. Display advertising accepted for insertion at minimum rate of $11 per column inch.

All Want Ads cash with order.

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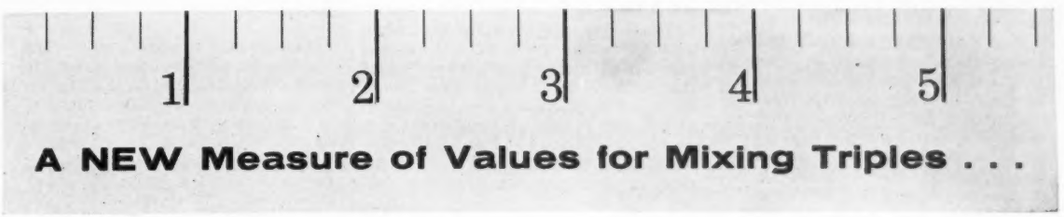
KILL BRUSH at low cost with amazing R-H Brush Rhap. Will not injure grasses, grains, cattle, or other animals. See your dealer, or write Reasor-Hill Corporation, Box 36CL, Jacksonville, Ark.

Bulk Handling Sales Manager Named

YOUNGSTOWN, OHIO—Lewis W. Lubenow was recently appointed field sales manager for the semi-bulk materials handling division of the Powell Pressed Steel Co., it was announced by William Powell, president.

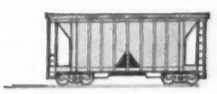
Mr. Lubenow has been active in both the materials handling and design engineering fields since 1939. Prior to joining Powell he was employed by the Delta Tank Manufacturing Co., Inc., Baton Rouge, La., where he developed a semi-bulk handling system. Earlier he served in sales and industrial engineering for U.S. Rubber in New York; design engineer with the Bakelite Corp. at Bound Brook, N.J., and with Farrel-Birmingham Co., Inc. of Ansonia, Conn.

A resident of Bloomfield, N.J., Mr. Lubenow attended New Haven College and Brooklyn Polytechnic Institute.



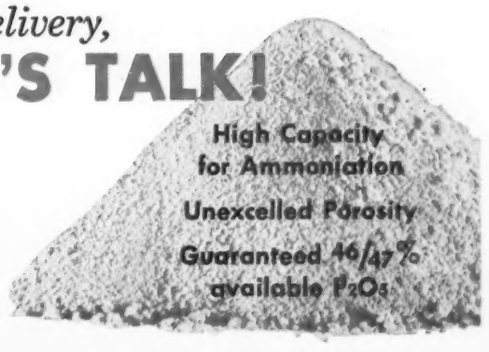
A NEW Measure of Values for Mixing Triples . . .

A TEST CARLOAD



OF NEW DAVISON HI-FLO RUN-O-PILE TRIPLE SUPERPHOSPHATE IS THE ONE SURE WAY TO PROVE TO YOURSELF THAT HI-FLO CAN SOLVE YOUR MIXING PROBLEMS

. . . whether they be quality, delivery, dependability or service. LET'S TALK!



GRACE W. R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

FOR THE PESTICIDE MANUFACTURER . . .

How to Convert Formulation Data for Production

By William R. Lucas
Assistant Manager
Wilmington Sales Region
Chemicals Division
Atlas Powder Company

ONE OF THE petty annoyances encountered by pesticide formulators is the difficulty involved in converting the usual terminology of "pounds per gallon" of pesticide formulation into the more useful production terms of "percent by weight" and "pounds of ingredient per batch."

This conversion normally involves considerable mathematical gymnastics and considerable searching in files and reference material for specific gravity data. It requires that the production man have a complete and detailed understanding of the variable factors involved in order to approach the problem and that he spend considerable time on non-productive mathematical computation of formulation data.

We set out to make this task as simple and straightforward as possible. The result is the attached chart which, through reference to the two tables and a few arithmetical operations, will enable the busy production man to convert the pounds per gallon formulation data to what he needs to get into operation—"percent by weight" and "pounds per batch," easily and accurately in a minimum of time.

The system is now being used on single toxicant and mixed solvent systems; for calculation of herbicide formulations on an acid equivalent basis; and as a check on the actual percent of toxicant in a given final formulation.

The latter has led to some interesting results, which cannot be detailed here. Suffice it to say that some formulators have found that they have had as much as 6.5 lb. per gallon of toxicant in a 6 lb. formulation, and others have found themselves dangerously close to having too little toxicant in their formulations—due to the fact that they failed to realize the effect of the specific gravity of the solvent on the final formulation when working from "percent by weight" formulations.

To effect the basic conversion we need a ready source of data on the specific gravity and strength or "nominal assay" of the toxicants in use, as well as the specific gravity of the common solvents. Tables 1 and 2 list these data for some of the common materials. Please bear in mind that these data are taken from published specifications available from the manufacturers at time of publication and are naturally subject to change at the manufacturer's discretion. It is therefore recommended that up-to-date figures be obtained either from the manufacturer or by test, thus avoiding misformulation due to variation in specification of ingredients.

The actual calculation of percent by weight and lbs. per batch is shown on the sample form, (Fig. 1). As an example, we have chosen a two lb. gal. DDT formula made up in 10° Xylene, with 2½% emulsifier specified. The first section of the form entitled "Data necessary for calculating" is immediately available. Sections A and E and Z are known without further reference. Sections B and C, the percent activity and specific gravity of the toxicant, are determined from Table 1 or from manufacturer's specifications. Section D, the specific gravity of the solvent, can be read from Table 2 or, as above, from manufacturer's specifications.

The first step, Section F, determines the part by weight of a gallon of finished formulation made up by the toxicant on a 100% activity basis. Substituting numerical values for letters in the blank formula, our initial formula would look like this:

$$\frac{2 \times 100}{100 \times 1.486 \times 8.34} = .1614$$

(8.34 equals wt. of water per gallon)

G, the part by weight made up by the emulsifier, is an even simpler direct substitution.

$$\frac{2.5}{100} = .025$$

The part by weight to be made up by solvent (H) is a straight subtraction of the totals of F and G, the parts by weight toxicant and emulsifier necessary to make up the 100 parts of finished formulation. That formula looks as follows:

1 - (.1614+.025)=1 - .1864=.8136

Step I, again a direct substitution, gives you the total specific gravity for the formula. Mathematically, it will look as follows:

(.1614x1.486)+.025+(.8136x.865)
.2398402 +.025+.703764

We recommend that in order to check the correctness of each step as well as the correctness of formulating technique, that an actual specific gravity check be run on the finished formulation produced in the plant and compared with the figure determined under I.

An even simpler check may be arrived at in J where the specific gravity is multiplied by the weight per gallon of water to arrive at a final weight per gallon of finished formulation.

.9686 x 8.34=8.07

The last section which determines the proportion of toxicant, emulsifier and solvent on both a "percent by weight" basis and a "pound per batch" basis, is the final step in reducing our pounds per gallon formulation to production terms.

The end result is that we have, in a simple step-by-step method, arrived at an accurate determination of the exact amount of each ingredient required in our final formulation. This system saves time and because of its simplicity, eliminates considerable possibility of error.

In earlier paragraphs, we referred to the fact that many formulators found mistakes in production formulas due to blind adherence to percent by weight formulations. It is strongly recommended that all formulas be checked on this form, using the actual specific gravity of materials on hand. It is very possible that discrepancies may appear between published weight/percent formulas and actal label requirements due to unpredictable differences in specific gravities.

The charts are now available to anyone in the agricultural chemical industry. Permission is granted for reproduction of the basic chart or will be furnished free of charge in any quantity desired when requested on company letterhead.

FIGURE 1

PROCEDURE FOR DETERMINING PESTICIDE FORMULATIONS
BY WEIGHT PERCENT AND BY POUNDS PER BATCH SIZE

2#/gal DDT in Xylene (10°) 2½% emuls

Data Necessary for Calculation

Pounds per gallon of toxicant desired	2	(A)
Percent activity of toxicant	100	(B)
Specific gravity of toxicant	1.486	(C)
Specific gravity of solvent	.865	(D)
Percent emulsifier	2.5	(E)
Batch size in gallons	100	(Z)

Now Calculate the Following:

What part (by weight) of a gallon is the toxicant on 100% activity basis

$\frac{A \times 100}{B \times C \times 8.34}$ = .1614 (F)

What part (by weight) of a gallon is the emulsifier

$\frac{E}{100}$ = .025 (G)

What part (by weight) of a gallon is left for solvent

1 -(F+G) = .8136 (H)

Specific gravity of total formula

(FxC) + G + (HxD) = .9686 (I)

Total weight of formula in pounds per gallon

I x 8.34 = 8.07 (J)

			% by Wt.		Lbs. per Batch	
Toxicant	DDT 75-75	$\frac{A}{BJ}$ x 10,000 =	24.8	% x $\frac{J \times Z}{100}$ =	200.0	lbs.
Emulsifier	4500/4600	Known =	2.5	% x $\frac{J \times Z}{100}$ =	20.2	lbs.
Solvent	Xylene	Subtraction=	72.7	% x $\frac{J \times Z}{100}$ =	586.7	lbs.
			100.0%			

SAMPLE CALCULATION — At left is actual calculation of percent by weight and pounds per batch for a 2½% emulsion of DDT in Xylene. A form of the typewritten portion of the chart may be made up for such problems and will prove helpful in arriving at answers to numerous formulation questions in the plant.

TABLE 1—TOXICANTS

No.	Trade name	Sp. Gr.	Nominal assay, %	No./ Gal.
1	Chlordane	1.59	100	13.26
2	Toxaphene	1.65	100	13.76
3	Toxaphene	1.56	90	
4	DDT	1.486	100	12.40
5	BHC	1.761	40	14.70
6	Lindane	1.712	100	14.29
7	Aldrin	1.587	91	13.25
8	Dieldrin	1.75	95	14.59
9	Endrin	1.701	95	14.19
10	Heptachlor	1.684	72	14.05
11	Methoxychlor	...	100	...
12	Rothane	1.29	100	10.75
13	E. Parathion	1.265	98	10.55
14	M. Parathion	1.235	80	
15	Malathion	1.22	95	10.17
16	Phosdrin	1.24	100	
17	Spray Oils		100	

TABLE 2—SOLVENTS

Solvent	Co.	Specific gravity at 60/60° F.
Xylene (10°)	1	.865
Socal No. 2	2	.858
Espesol No. 5	3	.845
Amsco Solv B. (Eastern)	4	.842
Hi-Solv-30	5	.840
HAN 132	1	.922
Espesol No. 2	3	.889
Bronoco No. 2306	6	.959
Hi Solv 473	5	.910
AR-55	7	.930
Solvesso-100	1	.870
Amsco Solv B. (Western)	4	.850
Toxisol B	10	.850
Bronoco X-Sol	6	.866
Espesol No. 5-A	3	.865
Espesol No. 5-B	3	.843
Bronoco Hi Sol 2206	6	.865
Amsco Solv B-75 (Western)	4	.847
Espesol No. 1	3	.874
Hi Flash	14	.870
Solvsol 27/37	12	.850
Solvent 100	13	.871
Amsco Solv B-90	4	.852
S. C. Solvent 100	11	.870
Solvent 7-R	15	.873
Panasol RX-3	9	.840
Special Solvent D-36	8	.854
S. C. Solvent No. 2-B	11	.839
Bronoco Hi Sol 30-D	6	.846
Special Solvent D-30	8	.840
Amsco Solv-D	4	.854
Special Solvent D-5	8	.860
Bronoco Hi Sol-30	6	.836
Amsco Solv F-80	4	.864
Amsco Solv G	4	.887
Socal No. 3	2	.896
Solvent-150	13	.893
Special Solvent D-62	8	.889
Panasol RX 22	9	.890
Solvesso 150	1	.893
S. C. Solvent 150	11	.893
Cosol No. 1	17	.870
Amsco Solv E	4	.915
Shell E 407 R	16	.892
Shell Aromatic Solvent 42	16	.892
Cosol No. 2	17	.900
Heavy Aromatic Solvent	11	.922
5c Heavy Aromatic Solvent	11	.928
H.A.N.	13	.932
Panasol AN-3	9	.996
AR-50G	7	.950
100 Heavy Solvent	17	.935
Sovacide 544C	18	.959
Amsco Solv HCC	4	.929
AR-55S	7	.930
Sovacide 544B	18	.997
No. 18	19	.941
Espesol No. 4	3	.995
Sovacide F	18	.930

TABLE 3—SOLVENT COMPANIES

No.	Company
1	Esso Standard Oil
2	Standard of California
3	Eastern States Chem.
4	American Mineral Spirits
5	Pieco (Pa. Industrial Chem. Corp.)
6	R. J. Brown Co.
7	Velsicol Corp.
8	Drake Pet. Co.
9	Amoco Chemicals Corporation
10	Richfield Oil
11	Solvent & Chemicals Group
12	Tidewater Associated
13	Humble Oil
14	Barrett Division, ACDC
15	Cal. Spray
16	Shell Oil
17	Neville Chem. Co.
18	Socony Mobile
19	Sinclair Oil

Croplife's Home Office

Croplife
PRODUCTION EDITION

BPA — *Member of Business Publications Audit*

NBP — *Member of National Business Publications*

CROPLIFE is a controlled circulation journal published weekly. Weekly distribution of each issue is made to the fertilizer manufacturers, pesticide formulators and basic chemical manufacturers. In addition, the dealer-distributor-farm adviser segment of the agricultural chemical industry is covered on a regional (crop area) basis with a mailing schedule which covers consecutively, one each week, three geographic regions (South, Midwest and West) of the U.S. On the fourth week, production personnel in fertilizer manufacturing and pesticide formulating plants throughout the U.S. are covered in depth. To those not eligible for this controlled distribution, Croplife's subscription rate is $5 for one year ($8 a year outside the U.S.). Single copy price 25¢.

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PRODUCTION EDITION

Editorial

PRODUCTION EDITION ARRIVES . . .

Fertilizer and Pesticide Plant People Are Targets of New Publication Just for Them

HERE is Croplife's PRODUCTION EDITION . . . the publication devoted exclusively to the men in fertilizer plants and pesticide plants responsible for production of chemical products used in agriculture. Editorial content of this and subsequent editions is presented to broaden the knowledge of production people and to aid them in keeping up with current developments.

The Production Edition is sent to key production people throughout the U.S. We invite them to take the magazine home with them for further study, and to take advantage of the booklets, brochures and other types of information available from suppliers by returning the self-addressed postal cards enclosed.

Not only from the articles will information be available, advertisers' messages carry many additional ideas for improvement in manufacturing methods and equipment and present helpful suggestions to production personnel.

The Production Edition will not attempt to specialize in news coverage, although it does carry capsule news of the week in which the edition is published. Should some major event take place at the time the Production Edition is issued, bulletin-type treatment will be given the story, with full details in Croplife the following week.

The Production Edition was launched to fill a need for more specific information to reach the man in the plant . . . the fellow responsible for the operation of production facilities . . . the man who can profit most from practical information of this type.

In many cases, he has been a sort of "forgotten man" with no regular publications being directed specifically to him alone. The problems faced by the production man are specific ones. So are those carried by management men who must work out mechanical problems as well as those concerning personnel, wages, public relations, insurance, the purchase of raw materials, storage and shipping.

We feel that these matters cannot be given their rightful attention short of taking dead aim and preparing material specifically in this production area. This we have done in this edition.

That there is a strong interest in matters pertaining to production of chemical products for agriculture is evidenced in many ways. One example is seen in the large attendance at the fertilizer industry round table discussions each fall. This indicates a definite hunger for more information.

The manufacture of fertilizers and pesticides is much too complicated to allow room for guesswork and lack of knowledge on the part of people in the plant. The quality of product must be uniformly high and the value of the material permits little waste or inefficiency in production.

For about a century the fertilizer industry stayed on a veritable plateau so far as advancement in manufacturing techniques was concerned. Following World War II the industry began to adopt newer methods, with granulation and other innovations becoming commonplace. This has been true of both fertilizers and pesticides.

So now the "forgotten man" in the plant is being remembered, and a hearty welcome is extended his way as a reader. We trust all of these production folks will not only look over their new publication carefully, but will take the trouble to write us their general reaction, suggestions for future articles and any other comment they wish to make, pro or con.

In addition, the publishers invite readers to jot down the names and job titles of fellow-production men who should be receiving this publication each issue. As stated on the card on page 14, the issue is sent free to all eligible production people. In case we might have overlooked any key production people in the plant, we should like to have the reader return the card, filled in, to let us know.

Next Production Edition
February 16, 1959

Welcome card

TEL. NO. HARRISON 7-

STANDARD

G. W. DAY

NITROGEN PRODUCTS
REPRESENTATIVE

STANDARD OIL COMPANY
910 SOUTH MICHIGAN AVENUE
CHICAGO 5, ILLINOIS

to buyers of

Anhydrous Ammonia and Nitrogen Solutions

A welcome card? Yes, indeed. Here's why:

1. This card is presented by a man from a company that backs up its salesmen's promises for delivery and for products that meet a customer's specifications.

2. The customer doing business with Standard Oil knows he is buying from a company with an established reputation . . . a company he knows will give him fair treatment, service and product quality.

3. Standard's modern Ammonia and Nitrogen Solutions plant is located in the heart of the country's largest rail- and truck-shipping area. To a customer this means fast, sure deliveries . . . deliveries that can be easily controlled because routes are direct and distances short.

A modern plant capable of producing Ammonia and Nitrogen Solutions on specification. A supplier who knows a customer's requirements *and delivers.* These add up to service a Midwest buyer of Ammonia and Nitrogen Solutions can depend upon. Would you like a Standard Oil man to call on you? Write, wire or telephone Nitrogen Products Department, **Standard Oil Company, 910 South Michigan Avenue, Chicago 5, Illinois.**

You expect more from STANDARD and get it!